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ABSTRACT

The purpose of this curriculum guide is to help teachers implement the Alabama Course of Study: Science. The major emphasis of the guide is to provide student-oriented, hands-on activities that engage students in "sciencing" behaviors. This guide has two major components, the table of contents and the activities. The table of contents lists by Roman numeral the units covered in grade 8. Each unit is organized into topics that describe further the content of the grade level. The smallest organizers in the table of contents are the student outcomes that describe in detail what students are expected to learn about each topic. After each outcome, a page number directs the reader to a classroom activity (or activities) that addresses the specific outcome. The second and largest component of the guide consists of classroom activities. Each activity begins with identifiers that summarize and introduce the activities. The identifiers are the Unit, Topic, and Outcome(s) addressed by the activity. Each activity contains a background section that provides teachers with information they may need to teach the activity effectively. Following the background, all materials needed for the activity are listed in a section entitled "Materials." Procedures for implementing the activity are outlined next. In some cases, extensions of an activity or source for an activity appear after the section on procedures. In addition, this curriculum guide include appendices that provide statements concerning classroom environment, Alabama's law relating to safety goggles, and the National Science Teachers Association position statements that address the issues of use of animals in the classroom, liability of teachers for lab safety and field trips, use of the metric system, science for the handicapped, and the importance of earth science education. Units include the following: (1) "Introduction--Scientific Investigations vs. Application, Metric System, Career Opportunities, and Laboratory Safety"; (2) "The Universe Overview"; (3) "Stars"; (4) "Our Solar System"; (5) "Space Exploration"; (6) "Earth"; and (7) Current Trends in Earth and Space Science." (KR)

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SCIENCE
CURRICULUM GUIDE

GRADE
8

EARTH and
SPACE
SCIENCE

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Alabama State Department of Education

Bulletin 1989, No. 78

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SCIENCE

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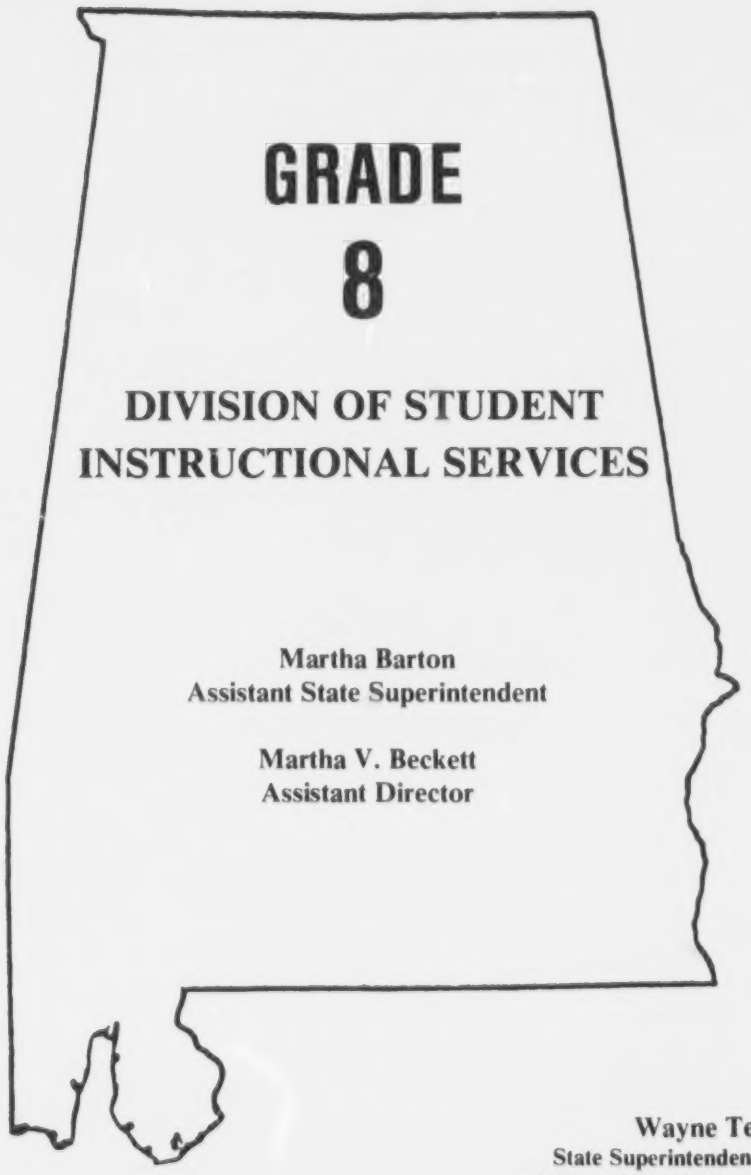

GRADE 8

DIVISION OF STUDENT INSTRUCTIONAL SERVICES

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Bulletin 1989, No. 78

INTRODUCTION

The science curriculum guides consist of nine documents, one for each grade kindergarten through grade eight. The purpose of these curriculum guides is to help classroom teachers implement the Alabama Course of Study: Science (Bulletin 1988, No. 35). The major emphasis of each guide is to provide student-oriented, hands-on activities that engage students in "sciencing" behaviors.

The two major components of the science curriculum guides are the Table of Contents and the activities. Each guide begins with the Table of Contents that lists by Roman numerals the units covered at a grade level. Each unit is organized into topics that describe further the content of the grade level. The smallest organizers in the Table of Contents are the student outcomes that describe in detail what students are expected to learn about each topic. After each outcome, a page number(s) directs the reader to a classroom activity (or activities) that address(es) the specific outcome.

The second and largest component of the guide consists of classroom activities. Each activity begins with identifiers that summarize and introduce the activities. These identifiers are the Unit, Topic, and Outcome(s) addressed by the activity. Each activity contains a Background that provides teachers with information needed to teach the activity effectively. Following the Background, all materials needed for the activity are listed in a section entitled Materials. Next, procedures for implementing the activity are outlined. In some cases, extensions of an activity or sources for an activity appear after the Procedures.

In addition, this curriculum guide includes Appendixes A, B, and C. These appendixes provide a statement concerning classroom environment, Alabama's law relating to safety goggles, and position statements from the National Science Teachers Association that address the following issues:

Code of Practice on Use of Animals in Schools,

Liability of Teachers for Laboratory Safety and Field Trips,

Use of the Metric System,

Science for the Handicapped, and

The Importance of Earth Science Education.

These appendixes provide science education information and professional assistance to the teacher.

The science curriculum guides are supplemental in nature. They were created to complement and enrich locally developed science curriculum plans and to provide instructional resources for all topics named in the Alabama Course of Study: Science. Consequently, each activity in the curriculum guide stands alone and does not need to be taught in the order presented in the document. It is expected that local education agencies will sequence the activities in this guide to correspond with the order in which topics are outlined in their locally developed scope and sequence for science.

ACKNOWLEDGEMENTS

From its inception, the development of curriculum guides has been viewed as a cooperative effort between specialists in the Division of Student Instructional Services and selected teachers from public schools in Alabama. While the Curriculum Development Section, under the leadership of Katherine Mitchell, had the responsibility for coordinating the project, approximately 75 educators contributed directly to the science curriculum guides.

Work on the science curriculum guides started in the fall of 1988 when Kay Atchison was selected as Project Director for grades K-6 and Donna Bentley was named Project Director for grades 7 and 8. The second phase of the project involved the recruitment and training of approximately 35 classroom teachers and university instructors who wrote activities for the guides. For six months (December 1988 through May 1989) writers created activities to address specific outcomes. The State Department of Education staff typed, edited, and proofread numerous drafts of the activities.

The contributions of persons and institutions listed below are greatly appreciated.

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GRADE 8
EARTH SCIENCE

UNIT: Introduction
TOPIC: Scientific Investigation vs Application
OUTCOMES: 1. Draw conclusions from inclusive evidence and experience.
2. Solve problems using organized data.

Background

This simple experiment helps students understand how to investigate, collect data, and draw conclusions concerning problems.

Prior to the activity, discuss with students the processes scientists use to investigate problems. Explain to students that in a scientific investigation, data must be collected in an orderly, accurate manner. Explain to students the steps in the scientific method including forming a hypothesis, designing and conducting an experiment, observing and recording results, and drawing conclusions.

On the chalkboard draw the following table:

Condition 1 (Direct rays)		Condition 2 (Slanted rays)	
Time	Temperature	Time	Temperature

Materials

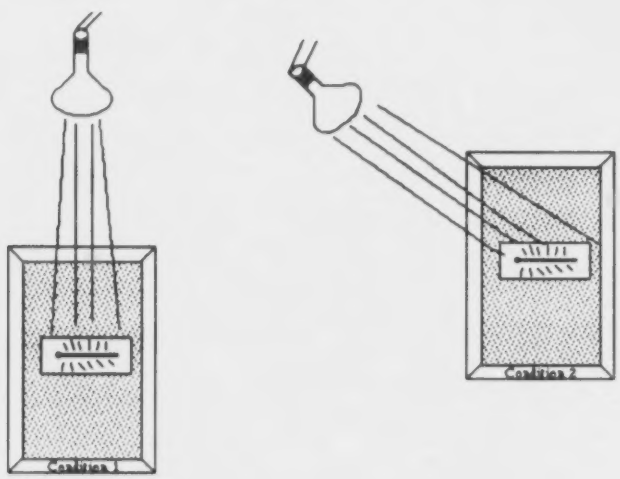
- Infrared heat lamp, or other lamp to produce heat
- Boxes the same size with low sides (2)
- Sand to cover bottom of each box to depth of 3 cm
- Thermometers (2)
- Globe
- Flashlight
- Chalkboard

Procedures

1. Tell students that this activity will provide a chance to design and perform an experiment, collect data from their experiment, and draw conclusions from data.

2. Ask students to imagine that light rays are shining straight down on a layer of sand. Ask students to imagine another situation in which the light is the same distance away from the sand, but the rays are shining on the sand at an angle. Ask students if the slanted rays make a difference in the temperature of the sand.

3. Show students all materials for the activity except the globe and flashlight. Ask students to use the materials to design and perform an experiment to measure the temperature of sand according to the situation described. Provide guidance, but let students have freedom in designing the experiment. One possible suggestion is shown below. In Condition 1, a heat lamp is placed so that the light rays shine straight down on the sand. In Condition 2, the heat lamp is placed the same distance from the sand but is tilted so that the rays strike the sand at an angle. Students may use the same heat lamp to test both conditions, but they should use different boxes of sand to ensure not having to wait for the sand to return to room temperature after the first test.



Before beginning the experiment, ask students to form a hypothesis. Will the difference in the slant of the rays effect the temperature of the sand? If so, what will be the result of this effect?

4. Have students record the temperature of the sand at regular, frequent intervals using a table similar to the one demonstrated on the chalkboard. If students need to make changes in the table on the chalkboard to fit the design of their experiment, have them complete any alterations prior to beginning the experiment.

5. Have students organize and begin their experiment. Have students measure and record the time and the temperature at specified intervals. Have students continue to record data until the temperature ceases to rise.

6. When students have recorded the sand temperatures under both conditions, call attention to the data recorded on the chalkboard. Ask students to draw conclusions from the data. Ask students why the angle of the light rays affects the temperature.

7. Ask students to enumerate situations in which temperature differences can be explained by the slant of the sun's rays.

8. Ask students why it is cold around the earth's poles and warm around the equator.

9. Have one student hold the globe while shining the flashlight toward the equator. Ask students which area of the globe receives the most direct light and what happens as the light rays approach the poles.

10. Ask students to use the data from their experiment to draw conclusions concerning the difference in temperature between the equator and the poles.

11. As a follow-up to this activity, have students prepare a written description of their experiment using steps of the scientific method.

GRADE 8
EARTH SCIENCE

UNIT: Introduction
TOPIC: Metric System
OUTCOME: 3. Measure using metric units.

Background

This activity gives students practice measuring in units of millimeters, centimeters, and meters. If students need to review the metric system and practice converting from one metric unit to another, lead them in the activity for Outcome 4 before completing this activity.

If metric rulers are not available for each student, place a metric ruler on a photocopy machine and make enough copies to ensure that every student has a ruler. Photocopy the ruler for each student on heavy paper.

Prepare a copy for each student of the Handout, MEASURING IN METRICS, and the Handout, METRIC SCAVENGER HUNT.

Materials

- Metric rulers
- Meter sticks
- Handout, MEASURING IN METRICS
- Handout, METRIC SCAVENGER HUNT

Procedures

1. Give each student a metric ruler and the Handout, MEASURING IN METRICS. Explain to students that this activity helps students practice measuring items in metric units. Ascertain that students are using metric units correctly by having them measure the items in Part 1 of the handout. Ask students to write their answers in centimeters and then in millimeters. Discuss answers. Help students who appear to be having difficulty comprehending the process.

2. Call attention to Part 2 of the handout. Opposite each length, ask students to draw a line segment of that length. Be certain students understand that 89 mm is the same as 8 cm and 9 mm.

3. Divide students into groups. Give each group a meter stick and the Handout, METRIC SCAVENGER HUNT. Explain to students that the handout contains a list of lengths. At a given signal, direct each group of students to find as many items in the classroom that approximate the measure of these lengths. Direct each group to write the names of items opposite the appropriate lengths on their handouts. (Note: If the weather permits, consider moving the scavenger hunt outdoors.)

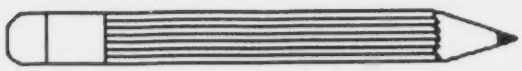
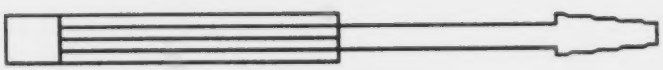
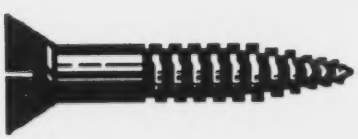
4. At the conclusion of the scavenger hunt, give each group time to compile a list of all items found for each length. Discuss answers with the students.

5. If time permits, reinforce students' understanding of metric distances by displaying or pointing to some of the items measured. Instruct students to estimate the approximate length of each item without referring to their handouts.

6. Use meter sticks to check accuracy of student estimates.

MEASURING IN METRICS
Handout

Part 1 Measure each item in centimeters and in millimeters.

Item	Measurement	
	cm	mm
1. 	_____	_____
2.	_____	_____
3.	_____	_____
4. 	_____	_____
5. 	_____	_____

Part 2 Use your metric ruler to draw line segments to represent the following lengths:

1. 15 cm
2. 89 mm
3. 6 cm 8 mm
4. 13 cm 7mm
5. 127 mm

METRIC SCAVENGER HUNT
Handout

Find as many items as you can in the classroom that approximate the measure of these lengths:

1. 290 mm _____
2. 13.5 cm _____
3. 30 mm _____
4. 24 cm _____
5. 215 mm _____
6. 5 mm _____
7. 1 m _____
8. 2 m 25 cm _____
9. 35 cm _____
10. 0.5 m _____

GRADE 8
EARTH SCIENCE

UNIT: Introduction
TOPIC: Metric System
OUTCOME: 4. Convert metric units to other metric units.

Background

The purpose of this activity is to review familiar basics of the metric system. This review activity may be used before the activity for Outcome 3.

Prior to beginning this activity, review the metric system with students. Include these points in the review:

- The metric system is mainly a decimal system, based on groups of ten. Because it uses tens, the metric system is easy to use. Each level of value is ten times higher or lower than the preceding one. Most scientists and other countries use the metric system.

- In the metric system, the basic unit of length is the meter. The basic unit of liquid capacity is the liter. A basic unit of mass is the gram. Each level of value above or below the basic unit has a different prefix. Some commonly used prefixes and their meanings include:

  kilo (1,000 or one thousand)
  hecto (100 or one hundred)
  deca (10 or ten)
  deci (0.1 or one-tenth)
  centi (0.01 or one-hundredth)
  milli (0.001 or one-thousandth)

On the chalkboard write the above listed prefixes and their meanings.

Obtain a film, filmstrip, or VHS recording on the metric system and show it to the students.

Prepare copies of the Handout, METRIC UNITS.

Materials

- Meter sticks
- Handout, METRIC UNITS
- One-liter plastic soft drink container
- Scale for measuring grams
- Chalkboard

Procedures

1. Show to students the film, filmstrip, or VHS recording on the metric system.

2. Review the metric system with students. Include information listed in the background section. Call attention to the prefixes listed on the chalkboard and discuss the information with students. Ask students to complete Part 1 of the Handout, METRIC UNITS, and discuss answers.

3. Divide students into groups. Give each group a meter stick. Ask students to note the way in which the meter measurement has been divided into smaller units. Ask students to name the smallest unit on the meter stick. (The smallest unit is the millimeter.) Ask students to name the next largest unit on the meter stick. (The next largest unit is the centimeter.) Ask students how many millimeters are in one meter. (There are 1,000 millimeters in one meter.) Ask students how many centimeters are in one meter. (There are 100 centimeters in one meter.)

4. Ask students to place five textbooks end to end. Using a meter stick, ask students to measure the combined length of the textbooks. Ask students to express their findings in three measurements: millimeters, centimeters, and meters. Direct students to write their answers in Part 2 of the Handout, METRIC UNITS.

5. Guide students as they complete Parts 3 and 4 of the Handout, METRIC UNITS. After students complete the assignment, have them share answers. Help students understand any metric conversions that were not previously understood.

6. Present to the students a one-liter plastic soft drink container. Ask the students to give orally the basic unit of measurement for liquid capacity in the metric system. (The basic unit is liters.) Show a scale. Ask the students to give orally the basic unit for measuring small amounts of mass. (The basic unit is grams.) Ask each student to compose and solve at least two metric conversion problems, one problem using liters and the other problem using grams. Remind students that the prefixes on the chalkboard may be used with liters, grams, and meters. Have students share problems with other group members. Direct each group to choose two problems for the class to solve. (If necessary, explain to students that they should compose workable problems and not problems of extreme difficulty.)

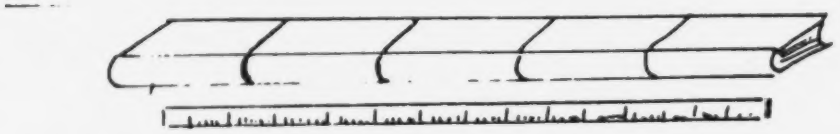
7. After students complete their problems, designate a student from each group to write that group's problems on the chalkboard. Depending on time availability, have students copy and work all problems written on the chalkboard or have volunteers solve the problems on the chalkboard. (Be sure volunteers do not work their own problems.)

METRIC UNITS
Handout

Part 1: Complete the table below.

Distance	Symbol	Number of Meters
kilometer	km	
hectometer	hm	
decameter	dam	
meter	m	
decimeter	dm	
centimeter	cm	
millimeter	mm	

Part 2: Place five textbooks end to end as shown.



Using the meter stick, measure the books. Record the following information below:

Combined length of textbooks in millimeters _____
Combined length of textbooks in centimeters _____
Combined length of textbooks in meters _____

Part 3: Express each measurement in at least three other metric units.

1. 9.8 m _____
2. 68 dm _____
3. 438 cm _____
4. 500 mm _____
5. 6.35 dm _____
6. 3.4 km _____

Part 4: Convert one metric unit of length to another metric unit of length.

1. 10 m = _____ dam
2. 10 m = _____ dm
3. 500 m = _____ hm
4. 200 m = _____ dam
5. 3100 m = _____ km
6. 0.5 km = _____ m
7. 40 hm = _____ m
8. 7 dam = _____ m
9. 50 cm = _____ m
10. 750 mm = _____ m

Part 5: Use this space to compose at least two metric conversion problems. At least one problem should use liters and one problem should use grams.

METRIC UNITS
Key

Part 1: Complete the table below.

Distance	Symbol	Number of Meters
kilometer	km	1,000
hectometer	hm	100
decameter	dam	10
meter	m	
decimeter	dm	0.1
centimeter	cm	0.01
millimeter	mm	0.001

Part 2:

(Note: Answers will vary depending on length of textbooks. Five textbooks placed end to end will usually measure between 1000 and 1250 millimeters, between 100 and 125 centimeters, and between 1 and 1.25 meters.)

Part 3: Sample answers include the following:

1. 9.8 m (98 dm, 980 cm, 98000 mm)
2. 68 dm (6.8 m, 680 cm, 6800 mm)
3. 438 cm (4380 mm, 43.8 dm, 4.38 m)
4. 500 mm (50 cm, 5 dm, 0.5 m)
5. 6.35 dm (635 mm, 63.5 cm, 0.635 m)
6. 3.4 km (3400 m, 340 dam, 34 hm)

Part 4: Convert one metric unit of length to another metric unit of length.

1. 10 m = 1 dam
2. 10 m = 100 dm
3. 500 m = 5 hm
4. 200 m = 20 dam
5. 3100 m = 3.1 km
6. 0.5 km = 500 m
7. 40 hm = 4000 m
8. 7 dam = 70 m
9. 50 cm = 0.5 m
10. 750 mm = 0.75 m

Part 5:

Answers will be determined by metric conversion problems composed by students.

GRADE 8
EARTH SCIENCE

UNIT: Introduction
TOPIC: Career Opportunities
OUTCOMES: 5. Differentiate between careers that are purely scientific and purely technological.
7. Discuss scientific professions and prerequisites of each.

Background

This activity concerns careers related to the field of earth science. Twenty-five careers are listed in the activity. Information concerning several of these careers is listed below because some vocations are difficult to locate in reference books. Additional information about prerequisites for some of the careers listed in this activity may be found in college catalogs.

- Aerospace Technician: This is a technological career. Aerospace technicians help engineers who design spacecraft and work in laboratories and at rocket-building sites. They must be trained to use computers and their hands to perform electrical and mechanical tasks.

- Astrophysicist: This is a scientific career. Astrophysicists must be educated in both the astronomy and physics areas, particularly in the fields of heat, light, and magnetism. Astrophysicists use their knowledge of physics and astronomy to help in their study of outer space.

- Engineering Technician: This is a technological career. Engineering technicians help engineers plan, build, and test machines and other products. They are trained in a particular field of technology at a community college or a technical institute and need a background in mathematics and science.

- Environmental Technician: This is a technological career. The goal of an environmental technician is to improve the environment. They may operate water-treatment systems, plant trees and shrubs, monitor pollutants being sent into the air by mills and factories, and help control noise caused by cars and airplanes.

- Geodesist: Geodesists measure areas of the earth to facilitate the making of maps. They work closely with cartographers to assure the accuracy of maps.

- Metallurgical Technician: This is a technological career. These technicians help test products made of metal. They work with engineers in laboratories where metal products are made.

- Oceanographic Technician: This is a technological career. These technicians study the world's oceans, keep records of all observations, and work closely with oceanographers.

- Science Writer: Science writers are employed by newspapers and scientific laboratories to explain recent events and discoveries in science to the public. They need a background in science and written communication.

- Soil Conservationist: This is a scientific career. Soil conservationists work with farmers to help find ways to prevent erosion and make the best use of land. They study changes in soil and find ways to improve poor soil.

Students should be divided into groups for this activity. The activity requires one or two class periods.

Prior to the activity, prepare copies of the Handout, SCIENCE CAREERS. Cut apart one handout so that each strip contains the name of one science career. Fold the 25 strips and place them in a can or small box.

Materials

- Reference material (encyclopedias, science dictionaries) from which students can obtain information concerning science-related careers
- Handout, SCIENCE CAREERS
- Chalkboard

Procedures

1. Ask students to describe people they know who work in science-related professions. Ask students to name many of these professions. Write students' answers on the chalkboard.

2. Ask students if they know which of these professions requires a college degree. Indicate with an asterisk those professions that require a college degree.

3. Ask students to identify the careers related to earth science areas. Circle the careers related to subjects to be studied during the school year.

4. Talk with students about the differences in scientific fields and technological fields. Explain to students that men and women in technical occupations help scientists with their work.

5. Explain to students that they will have an opportunity to learn about different types of earth science related careers. Divide students into groups. Give each group a reference book and a Handout, SCIENCE CAREERS.

6. Have each group select several strips containing the names of science careers from the Handout, SCIENCE CAREERS. Ask students to find the careers in the reference material. For each career, have students find answers to the following questions: What type of work does a person perform who chooses this career? Is this career a science field or a technical field? What types of subjects should a person study who wants to be employed in this career field? Ask students to write the research information on a sheet of paper.

7. When each group completes their assignments, designate a spokesperson to read aloud the recorded information. Tell the spokesperson NOT to indicate which career the information matches. Ask the other groups to listen carefully and decide which career on the Handout, SCIENCE CAREERS, matches the information presented by each spokesperson. Have groups circle their choices on the Handout, SCIENCE CAREERS. Ask the student reading the information to reveal the name of the career.

8. Have the groups take turns reading their information until all twenty-five careers have been presented.

9. Discuss reasons for the answers various groups have selected.

10. Have student volunteers explain to the class which career they would select for themselves and give reasons for the selection.

SCIENCE CAREERS
Handout

Aerospace Engineer

Aerospace Technician

Astronomer

Astronaut

Astrophysicist

Cartographer

Climatologist

Electrical Engineer

Engineering Technician

Environmental Technician

Geodesist

Geologist

Hydrologist

Limnologist

Metallurgical Engineer

Meteorologist

Mineralogist

Oceanographer

Oceanographic Technician

Nuclear Physicist

Paleontologist

Science Writer

Seismologist

Soil Conservationist

GRADE 8
EARTH SCIENCE

UNIT: Introduction
TOPIC: Career Opportunities
OUTCOME: 6. Classify scientists according to their areas of study.

Background

This activity is concerned primarily with science professions related to earth science areas. Before beginning the activity, help students gain knowledge to match scientists' titles with their areas of study by discussing the following root words: geo (earth), graph (writing), astro (star), aero (air), meteor (weather), limno (marsh, lake), hydro (water), paleo (ancient), seismo (shaking, earthquake), and nucleo (the nucleus).

Materials

- Tagboard, construction paper, or 3x5 inch index cards
- Scissors
- Glue
- Handout, SCIENTIST CARD

Procedures

1. Using the Handout, SCIENTIST CARD, make 10-15 sets of cards by cutting the patterns apart and gluing each drawing or definition on a separate card. Make a copy of the answer key to accompany each set of cards.

2. Divide students into groups of two or three and give each group a set of cards, answer key, and the following directions for playing a game entitled Scientist Match-up.

   - The object of the game is to match scientists with their areas of expertise.

   - Choose one student to be the dealer.

   - Distribute the description cards to the players. If three students are playing the game, the dealer gives each player 5 cards. If two students are playing the game, each player receives 7 cards and the extra card is placed face down on the table with the title cards placed face down on top of it.

   - The first player draws a title card from the pile of cards in the center. If the card matches one of the description cards in his/her hand, the player reads both cards aloud and places the pair on the table. Another player may challenge the match. If the challenger is correct (title and description cards do not match), the player who paired them loses one turn.

- If the card drawn by the player does not match one of the description cards in his/her hand, the player places the card face up next to the pile.

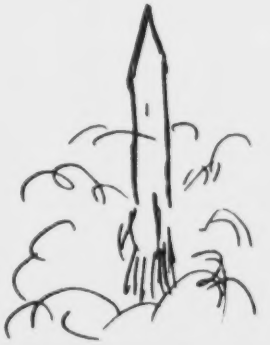
- Play progresses with each player either drawing a card from the pile or taking the top card from the discard pile.

- If all title cards are drawn, the discard is placed face down and play continues until all title and description cards are matched correctly. The player with the most cards matched correctly is winner of the game.

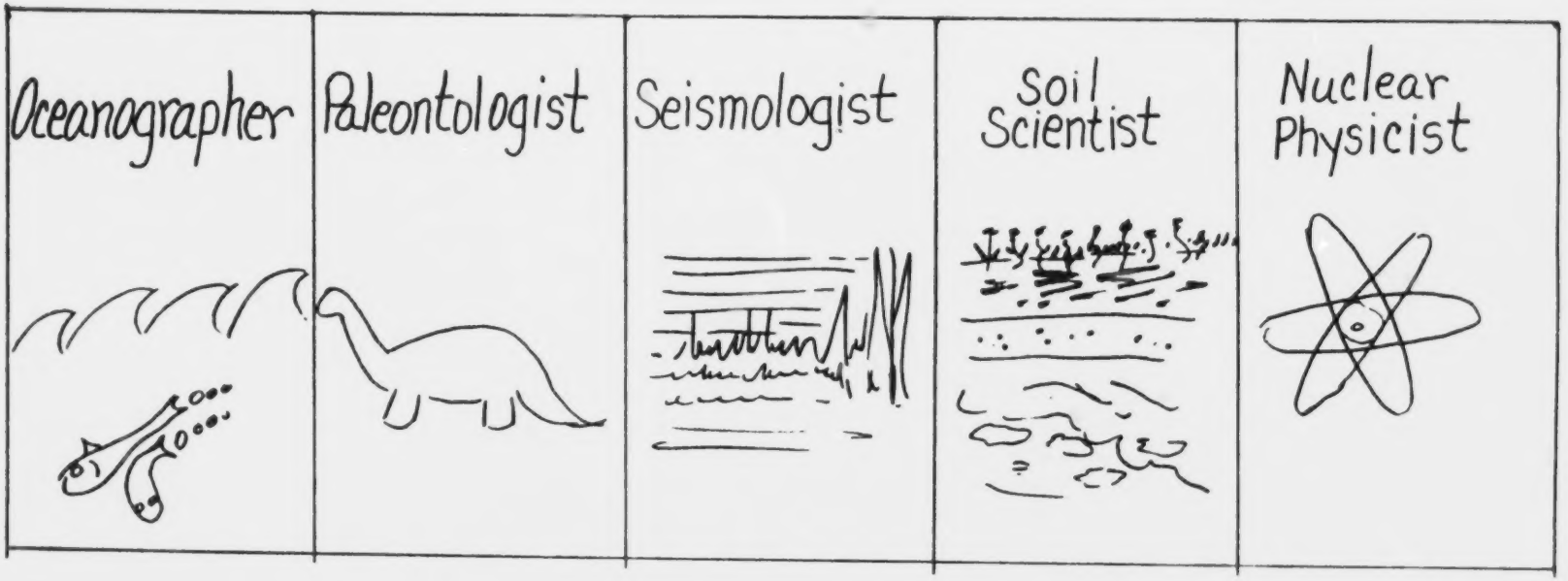
- The answer key may be used to check for accuracy of matches.

Variation

When students become proficient at playing the game, read the description cards aloud and let volunteers tell what title matches the area(s) or vice versa.

Geophysicist	Mineralogist	Geologist	Cartographer	Aerospace Engineer 
Astronomer	Meteorologist	Climatologist	Limnologist	Hydrologist

SCIENTIST CARD
Handout



SCIENTIST CARD
Handout

SCIENTIST CARD
Handout

A scientist who studies the universe and the laws that govern it	A scientist who specializes in the study of the weather and the atmosphere
A meteorologist who studies weather patterns of the past and compares them with weather patterns today	A scientist who studies inland bodies of fresh water, such as lakes and ponds
A scientist who studies the properties of water and the distribution and location of sources of water	A scientist who studies oceans, seas, and marine life
A scientist who studies living things of the past	A scientist who learns about the earth by studying the different seismic waves produced by earthquakes
A scientist who studies the physical, chemical, and biological characteristics of soil	A physicist who specializes in the study of atoms, atomic structure, and the behavior of nuclear particles

SCIENTIST CARD
Handout

	A person who studies the physical features of the earth and the forces that change or produce these features
	A person who specializes in the study of minerals
	A person who studies the earth's crust, the layers of which the crust is composed, and their history
	A person who plans, designs, and draws maps or charts
	An engineer who designs and develops aircraft, space vehicles, and testing equipment such as wind tunnels

SCIENTIST CARD
Key

Geophysicist: A person who studies the physical features of the earth and the forces that change or produce these features

Mineralogist: A person who specializes in the study of minerals

Geologist: A person who studies the earth's crust, the layers of which the crust is composed, and their history

Cartographer: A person who plans, designs, and draws maps or charts

Aerospace Engineer: An engineer who designs and develops aircraft, space vehicles, and testing equipment such as wind tunnels

Astronomer: A scientist who studies the universe and the laws that govern it

Meteorologist: A scientist who specializes in the study of the weather and the atmosphere

Climatologist: A meteorologist who studies weather patterns of the past and compares them with weather patterns today

Limnologist: A scientist who studies inland bodies of fresh water, such as lakes and ponds

Hydrologist: A scientist who studies the properties of water and the distribution and location of sources of water

Oceanographer: A scientist who studies oceans, seas, and marine life

Paleontologist: A scientist who studies living things of the past

Seismologist: A scientist who learns about the earth by studying the different seismic waves produced by earthquakes

Soil Scientist: A scientist who studies the physical, chemical, and biological characteristics of soil

Nuclear Physicist: A physicist who specializes in the study of atoms, atomic structure, and the behavior of nuclear particles

GRADE 8
EARTH SCIENCE

UNIT: Introduction
TOPIC: Laboratory Safety
OUTCOME: 8. Establish and review laboratory safety rules and procedures.

Background

Prepare copies of the Handout, LABORATORY SAFETY, and of the Handout, STUDENT SAFETY CONTRACT.

Prepare to demonstrate the location and use of laboratory safety equipment such as fire extinguishers, fire blankets, sand, and safety goggles.

Optional: Two weeks before reviewing laboratory safety rules with students, order the VHS videocassette "Lab Safety: The Accident at Jefferson High" (18 1/2 minutes) from Alabama Power Company, Educational Services, P. O. Box 2641, Birmingham, Alabama 35282-9984. The video shows students preparing for lab work, wearing proper clothing, handling lab equipment and chemicals, and reacting to emergencies.

Materials

- Handout, LABORATORY SAFETY
- Handout, STUDENT SAFETY CONTRACT
- Videocassette, "Safety in the Laboratory: The Lab Accident at Jefferson High." (optional)

Procedures

1. Give each student a copy of the Handout, LABORATORY SAFETY.

2. In order to help students consider reasons for specific laboratory safety rules, read the statements on the LABORATORY SAFETY answer key to students. After each statement, ask students to identify the corresponding laboratory safety rule on their handout. When discussing safety rules, encourage students to offer additional reasons for each safety rule.

   After all twelve laboratory safety rules have been discussed, ask students to determine other safety procedures which should be included. (Examples: cleaning laboratory work area or washing hands). Have students write the safety procedures in the appropriate place on their handout.

3. Show the Lab Safety videocassette to students. Ask students to identify specific laboratory precautions mentioned during the video.

4. Give each student the Handout, STUDENT SAFETY CONTRACT. Lead students in reading and discussing the contract. Ask each student to sign the contract.

LABORATORY SAFETY
Handout

1. Know where safety equipment in your classroom is located. Know how and when to use this equipment. Equipment may include fire extinguishers, fire blankets, sand, or a large sink with a water supply.

2. Never run, push, or engage in any kind of horseplay or practical jokes in the laboratory.

3. Never eat, drink, or chew gum in the laboratory. Never use laboratory equipment for eating purposes.

4. Tie back hair that is shoulder-length or longer.

5. Perform only the experiments assigned or approved by your teacher. The teacher should be present while completing lab work.

6. Wear safety goggles at all times during laboratory activity and in areas where chemicals are stored and handled.

7. Avoid looking at the sun under any conditions. Never look directly at ultraviolet lamps or bright light.

8. Never smell any substances without specific instructions. If the teacher instructs students to smell substances, fan some of the air above the substance toward your nose with your hand. Never inhale fumes directly.

9. Keep work areas clean and clear of unnecessary materials.

10. Dress properly for laboratory work. Roll long sleeves above the wrist. Wear a lab apron when working with chemicals or hot material.

11. Use special precautions when working with heat or fire.

    - Never leave hot objects unattended.
    - Never point the open end of a heated test tube toward anyone.
    - Do not keep flammable liquids near an open flame.
    - When lighting a gas burner, light the match, hold the match slightly above and to one side of the burner, and then turn on the gas.
    - Never reach over a flame.
    - Use tongs or pot holders to handle hot laboratory equipment.

12. Do not use broken, cracked, or chipped glassware.

LABORATORY SAFETY
Key

1. Laboratory safety includes being able to react immediately and properly to an emergency situation. (Rule #1. Know where safety equipment in your classroom is located. Know how and when to use this equipment. Equipment may include fire extinguishers, fire blankets, sand, and a large sink with water supply.)

NOTE: Use this opportunity to show students where safety equipment is located. Discuss situations in which the equipment would be needed and show students how to use the equipment.

2. In the laboratory, many accidents can result from something as simple as jarring or bumping. (Rule #2. Never run, push, or engage in any kind of horseplay or practical jokes in the laboratory.)

3. Dangerous substances can get into your body through your mouth. Residues left by other students can cause sickness or injury. (Rule #3. Never eat, drink, or chew gum in the laboratory. Never use laboratory equipment for eating purposes.)

4. Hair is extremely flammable. Hair may get into chemicals or other materials being used. (Rule #4. Tie back hair that is shoulder-length or longer.)

5. Unauthorized experiments may lead to unsafe combining or handling of chemicals and equipment. (Rule #5. Perform only the experiments assigned or approved by your teacher. The teacher should be present while you are doing lab work.)

6. Eyes must be protected against harmful vapors, materials that fall or splash, and hot materials or burners. (Rule #6. Wear safety goggles at all times during laboratory activity and where chemicals are stored and handled.)

7. The sun's intense light, as well as other kinds of bright light, may cause injury to the sensitive parts of your eye that you may not be aware of at the time. (Rule #7. Avoid looking at the sun under any conditions. Never look directly at ultraviolet lamps or bright light.)

8. Fumes from some substances are unsafe to inhale. Special precautions must be taken when smelling any laboratory substances. (Rule #8. Never smell any substances without specific instructions. To smell any substance, fan some of the air above the substance toward your nose with your hand. Never inhale fumes directly.)

9. Unnecessary clutter such as burned matches, paper towels, coats, and papers may present safety hazards. Good housekeeping shows a good attitude toward safety. (Rule #9. Keep your work area clean and clear of unnecessary materials.)

10. Long sleeves may present a safety hazard when working with chemicals or flames. Clothing and skin should be protected from chemical spills and burns. (Rule #10. Dress properly for laboratory work. Roll long sleeves above the wrist. Wear a lab apron when working with chemicals or hot materials.)

11. Dangerous burns, accidents, and explosions can result from carelessness while working with heat or fire. (Rule #11. Use special precautions when working with heat or fire. Never leave hot objects unattended. Never point the open end of a heated test tube toward anyone. Don't keep flammable liquids near an open flame. When lighting a gas burner, light the match, hold it slightly above and to one side of the burner, and then turn on the gas. Never reach over a flame. Use tongs or pot holders to handle hot laboratory equipment.)

12. Broken, cracked, or chipped glassware tends to break and chip further. It may cause cuts and spills. (#12. Do not use broken, cracked, or chipped glassware.)

STUDENT SAFETY CONTRACT
Handout

I shall:

- Follow all instructions given by the teacher
- Protect eyes, face, hands, and body while conducting laboratory activities
- Carry out good housekeeping practices
- Know where to get help fast
- Know the location of first aid and fire-fighting equipment
- Conduct myself in a responsible manner at all times in a laboratory situation

I,_____, have read and agree to abide by the safety regulations as set forth above. I also agree to abide by any other printed instructions provided by my teacher and/or school district. I further agree to follow all other written and verbal instructions given in the classroom or laboratory.

Date_____ _____
Signature

Source: National Science Teachers Association. Safety in the Secondary Science Classroom (Prepublication copy, 1977)

GRADE 8
EARTH SCIENCE

UNIT: The Universe Overview
TOPIC: Matter and Properties
OUTCOME: 9. Define matter, and states of matter.

Background

Matter is anything that has mass, occupies space, and exists in certain forms or states due to arrangements of the atoms making up the particular type of matter.

The three most common states of matter on planet Earth are solids, liquids, and gases. In a solid, atoms are packed tightly together in a fixed position producing a definite shape and volume and are resistant to change. A liquid contains atoms that touch each other but are free to move. Liquids have definite volume and indefinite shape. Their atoms resist changes in volume. Gases allow atoms to move independently of each other and take the shape of the container in which they are placed with less resistance to changes in volume than liquids.

A fourth state, plasma, is the most unusual of the four states of matter since it occurs only where there are charged atoms in nature. Examples of plasma are found in the outer layers of stars, when lightning occurs, or in a charged piece of metal ore. This state is difficult to observe.

Materials

- Paper
- Colored pencils (4) per student
- Metric rulers
- Reference books

Procedure

1. Discuss the placement of atoms in each state of matter. Ask the following questions during the discussion:

   a. Can you walk through a brick wall? Why or why not?
   b. Can you walk through water? Why or why not?
   c. Can you walk through air? Why or why not?

2. Give each student paper, four colored pencils, and a metric ruler.

3. Instruct students to divide the paper into four equal sections. At the top of each section draw a rectangle that is 4 cm by 2 cm.

4. Direct students to illustrate the placement of atoms in each of the four states by using triangles in one rectangle to represent solids, circles in one rectangle to represent liquids, squares in one rectangle to represent gases, and e+ and e- in the fourth rectangle to

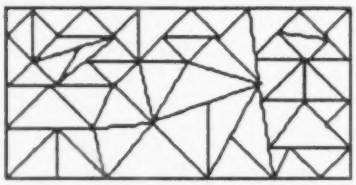
represent charged particles in plasma. Inform students that the specific arrangement of atoms will vary in different kinds of matter. (See sample sheet.)

5. Have students use the reference books to find specific examples of each state of matter.

6. Ask students to list five examples below each illustration and write a definition of each state of matter.

7. Discuss student answers and display illustrations in the classroom.

SAMPLE



SOLID

*** EXAMPLES ***

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_____
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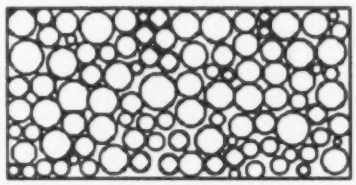
_____

DEFINITION: _____
_____
_____
_____
_____
_____



LIQUID

*** EXAMPLES ***

_____
_____
_____
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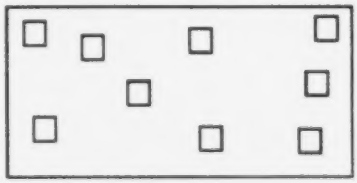
_____

DEFINITION: _____
_____
_____
_____
_____
_____



GAS

*** EXAMPLES ***

_____
_____
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DEFINITION: _____
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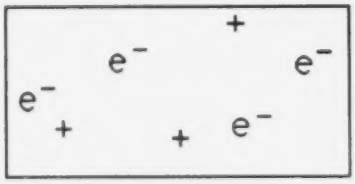
_____



PLASMA

*** EXAMPLES ***

_____
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DEFINITION: _____
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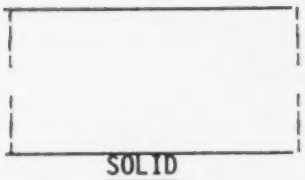
SAMPLE



SOLID

EXAMPLES

1. _____
2. _____
3. _____
4. _____
5. _____

DEFINITION: _____

_____
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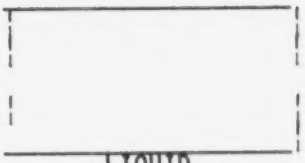
_____
_____
_____



LIQUID

EXAMPLES

1. _____
2. _____
3. _____
4. _____
5. _____

DEFINITION: _____

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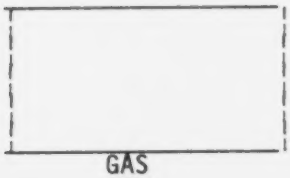
_____

SAMPLE



GAS

EXAMPLES

1. _____
2. _____
3. _____
4. _____
5. _____

DEFINITION: _____

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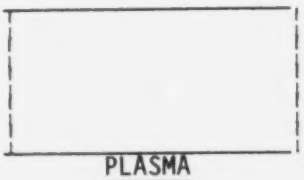

PLASMA

EXAMPLES

1. _____
2. _____
3. _____
4. _____
5. _____

DEFINITION: _____

_____
_____
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_____
_____

GRADE 8
EARTH SCIENCE

UNIT: The Universe Overview
TOPIC: Matter and Properties
OUTCOME: 10. Identify characteristics of matter.

Background

All matter has characteristics or properties. Recognition of matter is based on the specific characteristics that distinguish one type from othe types. The most commonly used methods for identification of matter are the senses: sight, smell, touch, taste, and hearing. Other methods include: density (amount of mass per unit of volume), solubility (abilit of one kind of matter to dissolve in another), and conductivity (ability to conduct heat or electricity).

Materials

- Salt
- Sugar
- Pepper
- Water
- Beakers
- Small plastic containers (4)
- Stirring rods
- Toothpicks
- Magnifying lens
- Teaspoon
- Handout, CHARACTERISTICS OF MATTER

Procedures

1. Before beginning the activity, place the following items into small plastic containers and label them as shown:

   Container #1 - 1/2 cup table salt - label Substance A
   Container #2 - 1/2 cup white granulated sugar - label Substance B
   Container #3 - 1/2 cup black pepper - label Substance C
   Container #4 - 1/2 cup water - label Substance D

2. Give each student a copy of the Handout, CHARACTERISTICS OF MATTER. Discuss characteristics of matter and ways of identifying matter with students.

3. Tell students that the activity requires use of the senses and solubility to identify four different kinds of matter. Warn students not to taste any of the substances unless directed to do so by the teacher. Warn students not to mix any of the substances together unless told to do so by the teacher.

4. Place the container of Substance A on a table. Place the toothpicks and a beaker of water beside the container.

5. Have students form lines on either side of the table. Direct students to select a toothpick, moisten one-half of the toothpick in the beaker of water, place the moist toothpick in the substance, and taste the substance. Have students smell and touch the substance.

6. Have students return to their desks and complete the first four blocks of the handout under Substance A.

7. Empty a teaspoon of Substance A into the beaker of water and stir. Allow all students to observe the beaker before completing the block labeled Solubility.

8. Direct students to hypothesize the identity of the substance and complete the conclusion block.

9. Repeat the procedure for sugar and pepper.

10. Discuss the characteristics and identity of each substance with the students.

CHARACTERISTICS OF MATTER
Handout

	SUBSTANCE A	SUBSTANCE B	SUBSTANCE C	SUBSTANCE D
SIGHT				
SMELL				
TASTE				
TOUCH				
SOLUBILITY				
CONCLUSIONS and IDENTITY				

GRADE 8
EARTH SCIENCE

UNIT: The Universe Overview
TOPIC: Matter and Properties
OUTCOME: 11. Observe and measure matter in different states.

Background

There are four states of matter which occur in nature: solid, liquid, gas, and plasma. The three most common states (solid, liquid, gas) are used in this activity. Water is used for the activity because it exists as a solid, liquid, and gas at the surface of the earth. The freezing, melting, and boiling points of water are reached between the low and high pressures and temperatures which are possible in nature.

Freezing point is the temperature at which a liquid becomes a solid.
Melting point is the temperature at which a solid becomes a liquid.
Boiling point is the temperature at which a liquid becomes a gas.

Materials

- Magnifying glasses
- Metal tongs
- Small rocks
- Ribbon
- Wire racks or ring stands
- Alcohol burners or Bunsen burners
- Plastic containers
- Water
- Graduated cylinders
- Beakers
- Handout, WATER AS A SOLID, A LIQUID, A GAS

Procedures

1. Before beginning the activity, place 25 ml of water in plastic containers and place in a freezer overnight.

2. Discuss with students the definitions of solid, liquid, gas, boiling point, melting point, and freezing point.

3. Divide students into groups and equip each group with a plastic container of ice, tongs, beaker, ring stand, alcohol or Bunsen burner, 3 small rocks, magnifying glass, and a piece of ribbon.

4. Give each student a copy of the Handout, WATER AS A SOLID, A LIQUID, A GAS. Direct students to answer the questions as the activity progresses.

5. Direct each group to observe the ice (solid) by touching, picking up with tongs, viewing through the magnifying glass, and placing a rock on its surface. Remind students to record observations on the Handout, WATER AS A SOLID, A LIQUID, A GAS.

6. Have groups measure 25 ml of water in the graduated cylinders and pour into a beaker. Direct students to repeat the same observations as with the ice: touching, picking up with tongs, viewing through the magnifying glass, and carefully placing the second rock into the water. Have students record all observations.

7. Direct each group to use the graduated cylinders to measure 25 ml of water and pour into a beaker. Tell students to place the beaker on a wire rack or on the platform of a ring stand and light an alcohol burner or Bunsen burner to place under the beaker. As the water heats, have students observe and record all observations.

   NOTE: Discuss with students lab safety when working with fire and hot objects.

8. Instruct each group to tie a piece of ribbon onto the end of the tongs and hold the ribbon over the beaker directly in the rising water vapor. Tell students to record each observation.

9. Direct students' attention to the ice. Have students remove the rock and record any observations.

10. Discuss student observations recorded during the activity.

WATER AS A SOLID, A LIQUID, A GAS
Handout

I. SOLID: ICE

1. At what point did the liquid water become a solid?_____
2. Describe touching ice._____

3 Were you able to pick up ice with tongs?____ Why?_____

4. Describe the appearance of ice when using the magnifying glass.

5. What observations were made after the rock was removed?_____

Why did this occur?_____
6. Draw the arrangement of the particles making up a solid.

II. LIQUID: WATER

1. At what point would a solid become a liquid?_____
2. Describe touching water._____

3. Were you able to pick up water with tongs?____ Why?_____

4. Describe the appearance of water when using the magnifying glass.

5. What observations were made when the rock was added to water?

6. Draw the arrangement of the particles that make up a liquid.

III. GAS: WATER VAPOR OR STEAM

1. At what point does a liquid become a gas?_____
2. What happened when the ribbon was held in the rising water vapor?_____ Why?_____

3. List all other observations concerning the water vapor produced.

4. Draw the arrangement of particles making up a gas.

IV. List other forms of matter found in nature for each state.

SOLID LIQUID GAS

GRADE 8
EARTH SCIENCE

UNIT: The Universe Overview
TOPIC: Matter and Properties
OUTCOME: 12. Define atom, element.

Background

Matter is anything that has mass and occupies space. Matter is composed of atoms which are too small to be seen with the most powerful microscopes. An atom is the smallest particle of an element that can exist and still retain all the properties of that element.

All matter consists of atoms which in turn form elements. Elements are the basic materials on the earth. Matter is different combinations of elements. Therefore, atoms with specific characteristics make up a specific element. There are eighty-eight elements in the natural state on earth. Elements are combined in thousands of ways with other elements, but each element can be broken down to its specific atoms with its own unique properties.

The purpose of this activity is for students to learn the symbols for a suggested number of elements for future studies.

Materials

- Colored pencils
- Index cards cut in half
- Handout, LIST OF ELEMENTS

Procedures

1. Discuss the definitions for atom and element. Explain to students that symbols for elements are a type of shorthand for use in science.

2. Tell students the correct method for writing element symbols is to capitalize the first letter but not subsequent letters. Give examples.

3. Inform students that some elements are titled by Latin names. Give examples.

4. Give students index cards, colored pencils, and the Handout, LIST OF ELEMENTS. Instruct students to write the name of an element on one side of the card and its symbol on the opposite side of the card.

5. Have students learn the symbols for each element listed on the handout.

6. Have students work in pairs showing the cards and naming the elements/symbols.

LIST OF ELEMENTS AND THEIR SYMBOLS
Handout

hydrogen	H	boron	B
sodium	Na	aluminum	Al
potassium	K	carbon	C
magnesium	Mg	silicon	Si
calcium	Ca	tin	Sn
barium	Ba	lead	Pb
radium	Ra	nitrogen	N
titanium	Ti	phosphorus	P
chromium	Cr	arsenic	As
manganese	Mn	antimony	Sb
iron	Fe	oxygen	O
cobalt	Co	sulfur	S
nickel	Ni	fluorine	F
platinum	Pt	chlorine	Cl
copper	Cu	bromine	Br
silver	Ag	iodine	I
gold	Au	helium	He
zinc	Zn	neon	Ne
mercury	Hg	argon	Ar
krypton	Kr	xenon	Xe
uranium	U	radon	Rn

GRADE 8
EARTH SCIENCE

UNIT: The Universe Overview
TOPIC: Matter and Properties
OUTCOME: 13. Describe a model of an atom.

Background

All atoms are made up of three main particles which have an electrical bond. In the center or nucleus, the protons with a positive charge and the neutrons which are neutral, are clustered tightly together. Moving around outside the nucleus are the electrons with a negative charge.

In this activity students learn the importance of and the relationship between the atomic number and the atomic mass or weight and the number of protons, neutrons, and electrons.

Materials

- Chalkboard
- Handout, PROTONS, NEUTRONS, AND ELECTRONS

Procedures

1. Write the following information on the chalkboard:

   a. the number of protons is the atomic number of an element
   b. the number of protons (+) equals the number of electrons (-)
   c. the number of protons (+) plus the number of neutrons (+) equals the atomic mass or weight of an element

2. Discuss this information with students and explain that electrons are so small and move so fast that their mass or weight is usually not calculated in the atomic mass of the element.

3. Give students copies of the Handout, PROTONS, NEUTRONS, AND ELECTRONS. Ask students to complete the handout using the information on the chalkboard.

4. After students have completed the handout, discuss answers.

PROTONS, NEUTRONS, AND ELECTRONS
Handout

I. Match the items in column A with those in column B.

1. proton	a. smallest unit of an element
2. neutron	b. negatively-charged particle
3. electron	c. positively-charged particle
4. atom	d. neutrally-charged particle
5. +	e. symbol for negative charge
6. $\pm$	f. symbol for positive charge
7. $\mp$	g. symbol for neutral or no charge

II. Complete the chart.

ELEMENT	SYMBOL	NUMBER OF PROTONS	NUMBER OF NEUTRONS	NUMBER OF ELECTRONS	AT. NUMBER	AT. WEIGHT
nickel	___	___	30	28	___	58
	Ra	88	___	88	___	226
cobalt	___	___	32	___	27	59
_____	Zn	30	___	30	___	65
uranium	___	92	146	92	___	___
_____	Cl	___	18	___	17	35
lead	___	82	___	82	___	207
_____	Si	14	14	14	___	___
aluminum	___	13	14	___	13	___
_____	S	16	___	16	___	32
silver	___	___	61	47	47	___
_____	Hg	80	___	80	___	201

GRADE 8
EARTH SCIENCE

UNIT: The Universe Overview
TOPIC: Matter and Properties
OUTCOME: 13. Describe a model of an atom.

Background

Atoms are made up of three main particles: protons, neutrons, and electrons. The protons and neutrons are clustered in the center or nucleus while the electrons move in levels or shells circling the nucleus. Each element has a different number of these particles. Atoms are so small that scientists have only an idea or hypothesis of what one looks like; therefore, only a mental model can be designed.

During this activity students draw an atom and label parts.

Materials

- Chalkboard
- Modeling clay (4 colors)
- Florist wire
- Wire cutter or old scissors
- Paper
- Pencils

Procedures

1. Direct students to draw a representation of an atom. Tell students to label the following parts: proton, neutron, electron, and nucleus.

2. While students are drawing and labeling, give each student one-half stick of four different colors of modeling clay and 4 or 5 florist wires.

3. Instruct students to choose one color to represent protons, one color to represent neutrons, one color to represent electrons, and the remaining color to use as a base or support for their model.

4. Demonstrate how to use a small amount (diameter of a dime) of clay to shape the clay into a ball representing a proton. Use the same procedure to represent a neutron. Shape a third piece like a ball that is half the size of the first two to represent an electron.

5. Direct students to make eight balls for protons, eight balls for neutrons, and eight smaller balls for electrons.

6. Have students cluster the protons and neutrons by gently pressing them together to form a ball to represent the nucleus.

7. Direct students to insert the florist wire through the clustered nucleus and out the opposite side. Repeat this procedure with a second wire being certain to go through the center of the clay nucleus.

8. Instruct students to curve the wire around the nucleus of the model and attach it to the opposite end to make a circle. Have students complete this process with the second wire. The wire represents the levels for the electrons.

9. Direct students' attention to the chalkboard. Explain that each level for electrons can hold only a certain number of electrons.

   Write the following on the chalkboard:

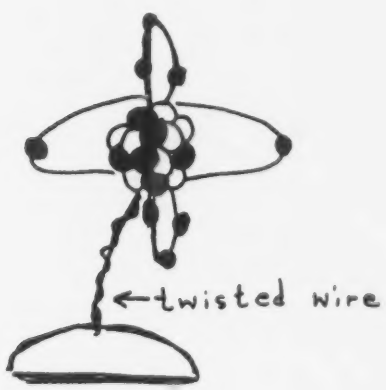
first level (one near the nucleus)	2 electrons
second level	8 electrons
third level	18 electrons
fourth level	32 electrons
fifth level	50 electrons
sixth level	72 electrons
seventh level	98 electrons

   Example: If an atom has three electrons, the first two electrons would be located on the first level and the third electron would be located on the second level.

10. Have students complete their models by placing the eight electrons on the 2 wires in the correct location.

11. After students have completed their models, have them take the fourth color of clay and shape it into a base to support the model. The complete models should resemble the example shown below.

12. Compare student models to earlier drawings.



GRADE 8
EARTH SCIENCE

UNIT: The Universe Overview
TOPIC: Matter and Properties
OUTCOME: 14. Explain crystal formation.

Background

In living things, growth results from taking in substances or food unlike themselves and changing it into their own substances. In nonliving things, growth results from the addition of new layers of their own substances. Crystals are nonliving solids in which there is an orderly arrangement of atoms forming characteristic patterns that are repeated to form a specific geometric shape. These geometric shapes help identify the type of substance. There are six different crystal systems: isometric, tetragonal, orthorhombic, monoclinic, triclinic, and hexagonal.

During this activity, students use an information sheet to determine the crystal systems illustrated by certain substances. Before beginning the activity, organize six work stations around the classroom with a microscope in each station. Equip each work station with a slide containing a different substance. Label each slide by name of the substance.

Materials

- Microscopes (6)
- Slides (6)
- Grains or crystals of salt, sugar or sulfur, gypsum or muscovite, calcite, plagioclase, and nickel sulfate
- Handout, CRYSTAL SYSTEMS CHART
- Reference books

Procedures

1. Give each student a copy of the Handout, CRYSTAL SYSTEMS CHART.

2. Direct students to visit each work station, write the name of the substance on their chart by the correct number, and view the crystal structure through the eyepiece of the microscope.

3. Have students draw the shape of the crystal system observed by the name of the substance.

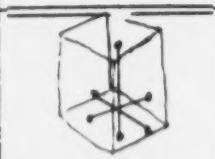
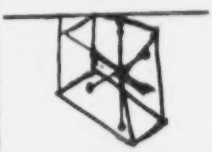
4. Instruct students to use reference books if assistance in completing the chart is required.

5. Discuss the type of crystal system for each substance.

6. Tell students that crystals continue to add layers like themselves and thus grow in size.

CRYSTAL SYSTEMS CHART
Handout

DIRECTIONS: Complete the examples column in the chart and use other information to help name the type crystal structures viewed with the microscopes.

SYSTEM NAME	IDEAL SHAPE	LENGTH OF AXES	EXAMPLES
isometric		all three axes equal	STATION #1
tetragonal		two horizontal axes equal third axis different	STATION #2
orthorhombic		all three axes unequal	STATION #3
monoclinic		all three axes unequal	STATION #4
triclinic		all three axes unequal	STATION #5
hexagonal		three horizontal axes equal fourth axis different	STATION #6

CRYSTAL SYSTEMS CHART
Key

Isometric	Station #1	salt
Tetragonal	Station #2	nickel sulfate
Orthorhombic	Station #3	sugar or sulfur
Monoclinic	Station #4	gypsum or muscovite
Triclinic	Station #5	calcite
Hexagonal	Station #6	plagioclase

GRADE 8
EARTH SCIENCE

UNIT: The Universe Overview
TOPIC: Matter and Properties
OUTCOME: 15. Read and explain the periodic chart.

Background

Before beginning the activity, review the definitions of matter, atoms, atomic number, and atomic weight.

All elements are based on the Periodic Law which states: "The physical and chemical properties of the elements are periodic functions of their atomic numbers." The elements are classified and put in the form of a chart.

Materials

- Handout, PERIODIC TABLE

Procedures

1. Give each student a copy of the Handout, PERIODIC TABLE.

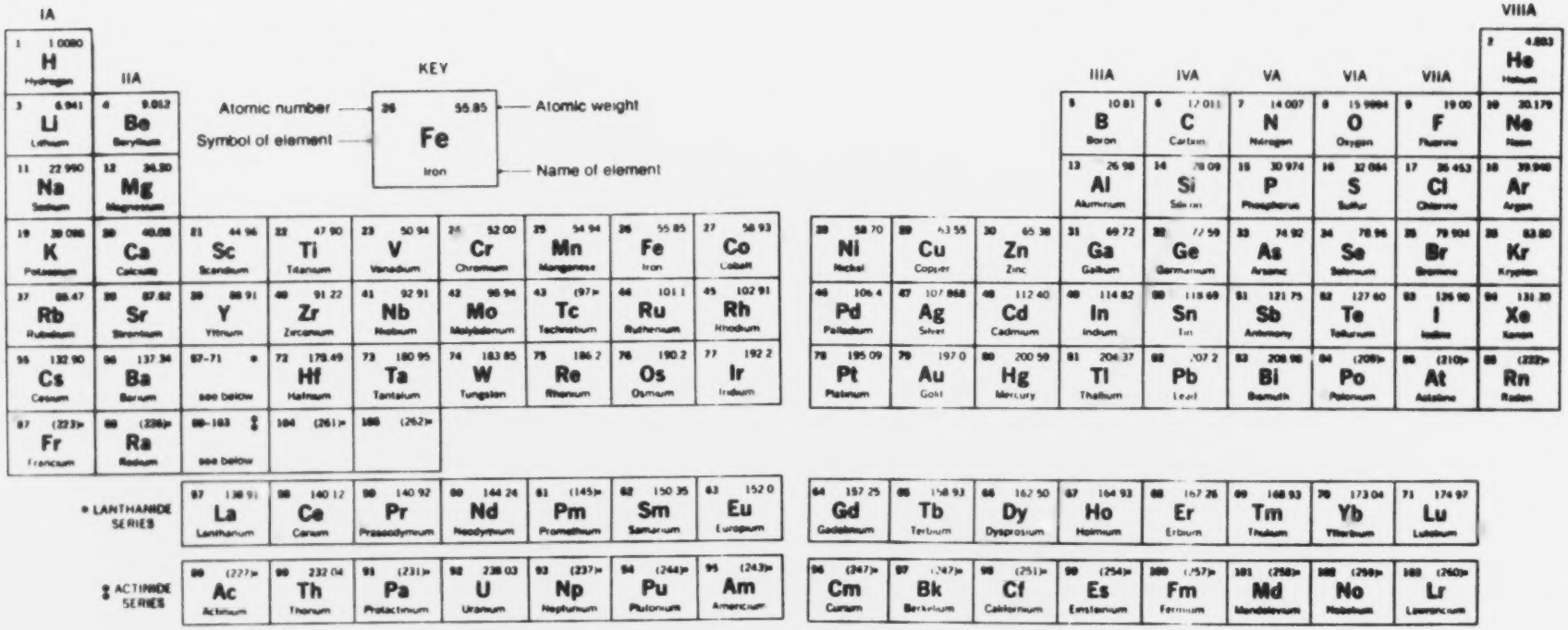
2. Instruct students to scan the handout and note the following:

   a. Vertical columns--each is a period or family.
   b. Seven horizontal rows--each is a period or series.
   c. Each block is numbered left to right--number represents atomic number of element.
   d. Each block contains a symbol and name for an element.
   e. Each block has the mass number of the element.

3. Explain that the Lanthanide and Actinide Series are groups set apart because of similarities. All Actinides are radioactive.

4. Discuss the importance of having a system of classification for elements.

PERIODIC TABLE
HANDOUT



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GRADE 8
EARTH SCIENCE

UNIT: The Universe Overview
TOPIC: Matter and Properties
OUTCOME: 16. Demonstrate how molecules can be formed and broken.

Background

Before beginning this activity, briefly review the following relationships:

a. All matter is made up of atoms.
b. An atom is the smallest unit of an element.
c. Two or more elements chemically combined form a compound.

The smallest possible part of a compound that will retain all the properties of that compound is a molecule. In order for a compound to form, the elements involved must have an electron attraction or sharing. To break up this established relationship of shared electrons, force of some type must be used.

In this activity students will illustrate the attraction or sharing of electrons to form compounds and then participate in a class discussion of how this sharing can be broken.

Materials

- Pencil
- Handout, FORMATION OF MOLECULES
- Chalkboard

Procedures

1. Give each student a copy of the Handout, FORMATION OF MOLECULES.

2. Draw and discuss the example shown on the handout on the chalkboard. Explain the relationship of each element to the compound formed.

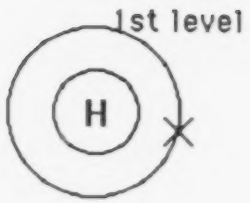
3. Direct students to complete the illustrations for each of the other compounds listed on the handout.

4. Ask student volunteers to draw their illustrations on the chalkboard. Have students discuss the drawings.

5. Explain to students that once compounds have formed, it is difficult to break them apart under ordinary conditions. Give students examples of how compounds are formed.

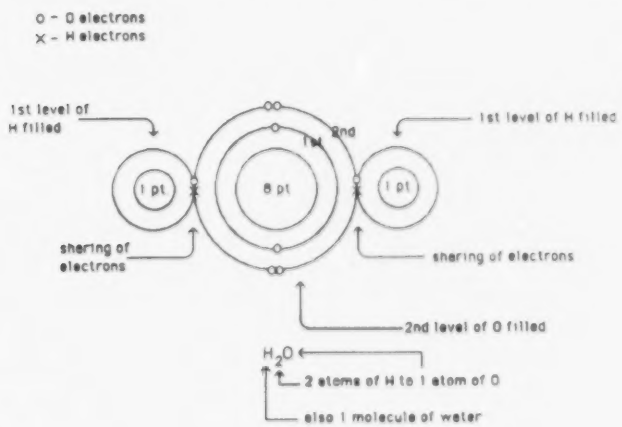
FORMATION OF MOLECULES
Handout

I. EXAMPLE:



hydrogen	oxygen
1 proton	8 protons
1 electron	8 electrons

EXPLANATION: Hydrogen needs one more electron to fill its first level to capacity; oxygen needs two electrons to fill its second level to capacity; these two H atoms combine or join with one O atom producing a compound called water.



II. Using a periodic chart to find the atomic number (number of p+ and e-), illustrate the placement of electrons in the following compounds.

(a) carbon dioxide--CO_2
(b) calcium carbonate--$CaCO_3$
(c) methane--CH_4
(d) epsom salt--$MgSO_4$

GRADE 8
EARTH SCIENCE

UNIT: The Universe Overview
TOPIC: Matter and Properties
OUTCOME: 17. Discuss law of gravity.

Background

The old saying "What goes up must come down" is true of objects near the surface of the earth. Gravitational attraction of the earth for objects near its surface is called gravity. A measure of gravitational pull of the earth on objects near the surface is termed weight. Weight can change from one location to another, but the mass of the object always remains the same.

In this activity students learn basic principles about gravity. Several factors determine how long it takes an object to fall: acceleration or the speed of the object, outside resistance, and shape of the object.

Materials

- Stop watch
- Paper

Procedures

1. Discuss with students the definition of gravity. Ask students to state specific examples of the law of gravity.

2. Give students blank sheets of paper. Instruct students to design and construct an airplane.

3. Encourage students to use shapes that will keep their airplanes flying for an extended period of time.

4. When students have completed making the airplanes, conduct a flight contest. Use a stopwatch to determine the length of time each airplane flies.

5. Discuss principles of gravity and apply the principles to the flight of airplanes.

GRADE 8
EARTH SCIENCE

UNIT: The Universe Overview
TOPIC: Energy
OUTCOMES: 18. Name the types of electromagnetic radiation.
19. Interpret the electromagnetic radiation spectrum and frequencies.

Background

All forms of radiant energy from the sun are represented in the electromagnetic spectrum according to wavelengths. These forms of radiant energy are gamma rays, x-rays, ultraviolet waves, infrared waves, microwaves, radio waves, and visible light.

The forms of energy travel in waves at the speed of light (186,000 miles/sec; 300,000 km/sec). Different wavelengths and frequencies are used to identify each form of radiant energy.

Wavelength is the distance between two wave crests. Frequency is the number of waves per second.

The electromagnetic spectrum is used to position the radiant energy forms from longest wavelengths, radio waves, to the shortest wavelengths, gamma rays.

Materials

- Colored pencils
- Handout, ELECTROMAGNET SPECTRUM
- Chalkboard
- Reference books

Procedures

1. Write the forms of radiant energy on the chalkboard. Explain to students the definitions of wavelength and frequency.

2. Give to each student a copy of the Handout, ELECTROMAGNETIC SPECTRUM.

3. Direct students to complete the handout using the reference books.

4. After the handout has been completed, direct individual students to explain the importance of the types of radiant energy forms.

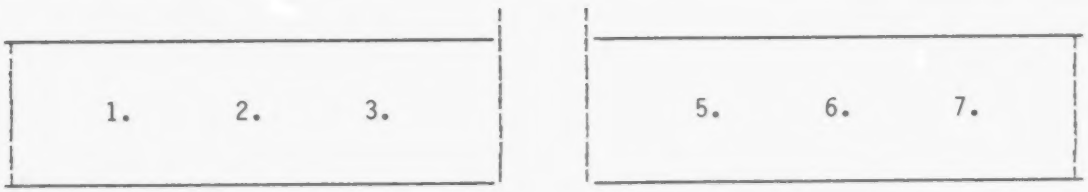
ELECTROMAGNETIC SPECTRUM
Handout

I. Using reference books, place the forms of radiant energy in the diagram of the electromagnetic spectrum according to the wave lengths--longest to shortest.

_____

_____

4



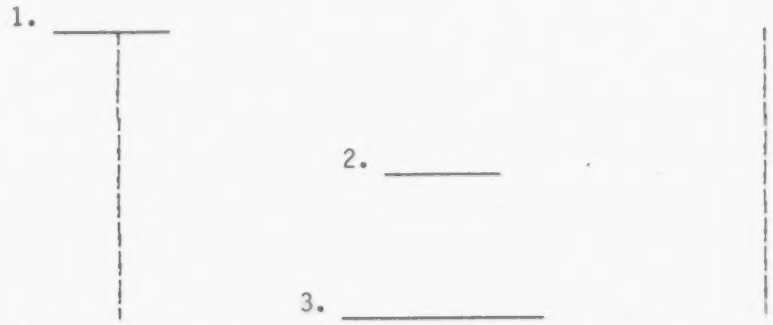
II. List the colors of visible light. (In order)

1. _____ 2. _____ 3. _____ 4. _____ 5. _____

6. _____ 7. _____

III. Color the visible light span--the colors in order as listed above.

IV. Label the parts of a wave.



V. Draw a wavelength to represent each form of radiant energy.

GRADE 8
EARTH SCIENCE

UNIT: The Universe Overview
TOPIC: Energy
OUTCOME: 20. Explain quasar and pulsar.

Background

Quasars are starlike objects but do not appear to be stars. Astronomers refer to them as quasi-stellar radio sources that are vast distances from earth. They are celestial objects different from anything known to date. Quasars are powerful sources of radio energy. There is a great deal not known about these objects. They appear to move at very fast speeds.

Pulsars are newly discovered radio sources. It is generally believed that pulsars are neutron stars which are extremely dense. They "pulse" at a uniform rate of once every three and one-half seconds.

What is known about quasars and pulsars has been learned through radio astronomy, a young science concerned with gathering radio energy from outer space.

Materials

- Reference books

Procedure

Assign students to groups to research the following questions concerning radio astronomy:

1. When did radio astronomy begin?

   Answer: Late 1940's.

2. How do radio telescopes work?

   Answer: Disc receivers detect radio waves emitted from distant objects.

3. When were quasars and pulsars first detected?

   Answer: Between 1964 and 1967.

4. What are quasars and pulsars?

   Answer: Not known. Their true nature has not been determined.

GRADE 8
EARTH SCIENCE

UNIT: The Universe Overview
TOPIC: Energy
OUTCOME: 21. Demonstrate the Doppler effect.

Background

The Doppler effect is the apparent change in frequency of sound, light, or radio waves caused by motion. The pitch of the sound does not actually change. The Doppler effect is utilized in radar systems for determining the speed of objects. It can be effective in tracking airborne objects.

Materials

- Blank paper
- Pencil
- Chalkboard

Procedures

1. After a discussion of wavelengths, direct students to draw a vehicle of some type--car, truck, motorcycle, or plane--in the center at the top of a sheet of blank paper.

2. After students have completed their drawing, direct them to look at the vehicle and imagine sound waves moving out in front of the car and sound waves moving behind the vehicle. Tell students that the vehicle is not moving but the motor is running. Direct students to draw sound waves in this situation in front of and behind the vehicle.

SOUND WAVES

MOTOR RUNNING
NOT MOVING

3. Direct students to draw the vehicle again in a lower place on the sheet of paper. Explain to students that the vehicle's motor is running and moving fast. Tell students to "THINK" and draw how the sound waves would appear in front of and behind the car.

SAME PITCH
MOTION MAKES--
SOUND DIFFERENT

MOTOR RUNNING
MOVING FAST

4. Instruct students to write an explanation of what has happened and why.

5. Allow a student (volunteer) to draw his/her vehicle on the chalkboard and give an explanation of the sound waves created by the motor of the car.

GRADE 8
EARTH SCIENCE

UNIT: The Universe Overview
TOPIC: Energy
OUTCOMES: 22. Define energy.
23. Demonstrate energy forms and energy transformation.
24. Relate the use of energy to its form.

Background

Energy is the ability to do work. The sun is the source of energy through sunlight that is used by all life forms on earth.

There are three major methods of heat transfer that occur in nature due to radiant energy. They are conduction, convection, and radiation.

During this activity students observe a demonstration of each form of heat transfer and identify each form.

Materials

- Hot plate
- Pan
- Water
- Ribbon
- Curling iron
- Hair dryer

Procedures

1. Discuss conduction, convection, and radiation with students.

2. Tell students that the three types of heat transfer will be demonstrated. Direct students to observe each demonstration carefully, and draw and label an illustration of each type.

3. Plug the hot plate into an electrical outlet and turn it on the high setting. As the coils become red because the coils serve as resistors, thus generating electrical heat (conduction), ask a student volunteer to hold a hand 12-15 inches above the coils and describe the feeling. Ask students what type of heat transfer this example represents. Energy in the form of heat is transmitted through air and absorbed by another body (radiation).

4. Place a pan of water on the hot coils. Ask students what happens as the water begins to boil. Hold a piece of ribbon directly over the boiling water. Ask a student volunteer to describe what happens and tell what type of heat transfer this example represents. (convection)

5. Display the curling iron (conduction) and hair dryer (radiation) for the students. Ask students what type of heat transfer these examples represent.

6. Discuss examples of these three methods of heat transfer that occur in nature.

GRADE 8
EARTH SCIENCE

UNIT: The Universe Overview
TOPIC: Energy
OUTCOME: 25. Discuss solar and nuclear energy.

Background

Solar energy is produced by the process of fusion. Fusion is the fusing or forcing of two atoms together releasing an extremely large amount of energy. This process takes place constantly in the sun.

Nuclear energy is the result of fission or the splitting of the nucleus of a single atom. Fission also produces a great volume of energy.

This activity involves library research and a class presentation on the advantages and disadvantages of solar and nuclear energy.

Materials

- Reference books
- Chalkboard

Procedures

1. Divide the class into four teams and assign the following topic for research: The Pros and Cons of Solar and Nuclear Power as Energy Sources in Today's Society.

2. Tell students to spend one day in the school library collecting research information and one day in the classroom assembling and preparing the information for an oral presentation with visual aids.

3. Take students to the library and assist them in locating materials on solar and nuclear energy.

4. Following the library work, allow students one day of classroom time to prepare five-minute presentations.

5. Have each group make a presentation. Direct students to list important pros and cons as they are presented by the groups.

6. List pros and cons on the chalkboard and review the information with students.

GRADE 8
EARTH SCIENCE

UNIT: The Universe Overview
TOPIC: Galaxies
OUTCOMES: 26. Explain the characteristics of the Milky Way Galaxy.
27. Recognize types of galaxies.
28. Describe evidence of changes in the galaxy.
29. Illustrate a top view and side view of the galaxy.
30. Locate the solar system on a top or a side view of the galaxy.

Day 1

Background

There are three classifications of galaxies based on appearance of each classification.

Irregular Galaxies:	Have irregular boundaries Some have developing spiral arms
Elliptical Galaxies:	Symmetrical Range from spheres to flattened dish shape
Spiral Galaxies:	Have one or more spiral arms Rotate around a distinct, dense center

Our solar system is one small part of a spiral galaxy, the Milky Way Galaxy. Astronomers report that our galaxy appears to be expanding in volume as it races through space.

Materials

- Paper
- Pens (felt tipped or ball-point)
- Chalkboard

Procedures

1. Place the names and description of each classification of galaxy on the chalkboard and discuss each classification with students.

2. Have students illustrate and label each classification by placing dots on a sheet of paper in correct patterns. Ask students to label each classification.

Day 2

Background

Clusters of stars are held together by gravity and rotate around a central point. The number of stars in a galaxy is estimated to be in the hundreds of thousands of millions. Our solar system, including the planet Earth, belongs in the Milky Way Galaxy.

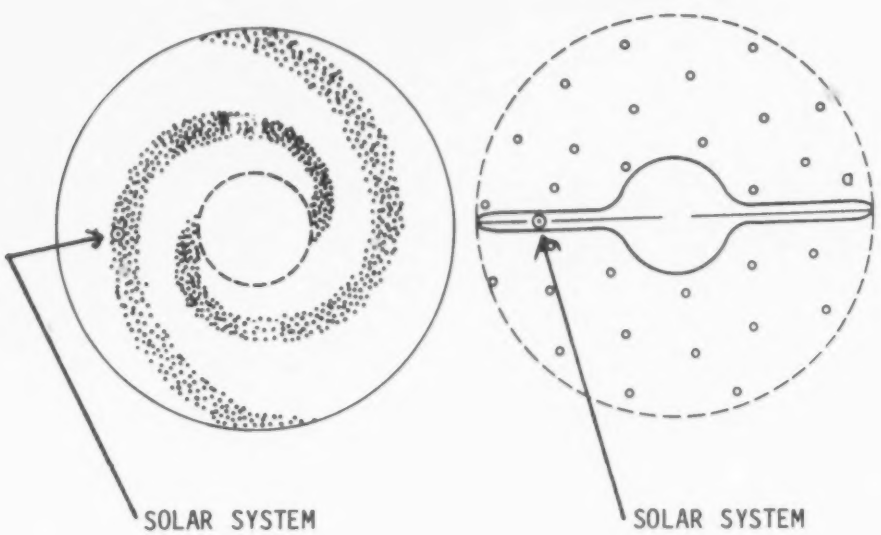
The Milky Way Galaxy has an estimated diameter of 80-100 thousand light years. It is a spherical system of stars concentrated toward the center with a flat-dish shape and arms that spiral outward. Our solar system is located on one of the arms approximately 30,000 light years from the center.

Materials

- Construction paper (black)
- Glue
- Glitter
- Gummed stars

Procedures

1. Draw the shape of the Milky Way Galaxy on the chalkboard as shown below. Discuss the illustrations with students.



SIDE VIEW TOP VIEW

2. Using glue, have students outline the two views of the Milky Way Galaxy on the black construction paper.

3. Have students sprinkle glitter over the outlines while the glue is wet. Point out to students that the glitter represents stars.

4. Give each student two gummed stars. Direct the students to position the stars on the outlines to represent our solar system.

GRADE 8
EARTH SCIENCE

UNIT: The Universe Overview
TOPIC: Methods of Investigation
OUTCOME: 31. Recognize designs of astronomical instruments.
32. Discuss use of astronomical instruments.
33. Compare and contrast the refracting and reflecting telescopes.

Background

Astronomical observations using telescopes began in the early 17th century when Galileo trained his crudely-made refracting telescope on the moon. His telescope had about the same capability that a standard pair of binoculars has today. Binoculars are actually two refracting telescopes put together, one for each eye. Encourage students to discover the same wonders of the night sky that Galileo did by using binoculars to stargaze.

Refracting telescopes consist of a large convex lens that gathers light and refracts or bends the light rays. The body tube length of the telescope is determined by the distance required for refraction. Just beyond the point where the rays converge, a small lens is placed that serves as an eyepiece.

Reflecting telescopes were developed later, based primarily on the work of Isaac Newton. A concave mirror, instead of a refracting lens, gathers light and focuses the light onto an eyepiece. Reflecting telescopes tend to be less expensive because large refracting lenses are more costly than mirrors.

The primary purpose of this activity is to help students appreciate the knowledge that man has gained through utilization of light-gathering telescopes, in spite of "limiting factors" that place severe restrictions on man's ability to see clearly into the night sky. Most of what man has learned about the heavens has been possible because of the ability of telescopes to gather and magnify light rays.

Materials

- Handout, LIMITING FACTORS
- Blank index cards

Procedure

1. Divide students into groups to play the LIMITING FACTORS GAME.

2. Distribute the Handout, LIMITING FACTORS, to each group along with a sufficient number of blank index cards.

3. Have students in each group divide the task of writing a "factor" on one side of a card and the "limits" on the other side of the card to achieve one set of cards, consisting of nine limiting factors.

4. Explain to students that the game is a simple, oral question-and-answer procedure between members of the group. As the factor side of a card is shown by a dealer, members of the group give the limiting factors.

LIMITING FACTORS
Handout

FACTORS	LIMITS
1. SIZE OF REFRACTING LENS	1. Limited by weight of large lens and distortion caused by gravity
2. CHROMATIC ABBERATIONS	2. Imperfections in glass used to make refracting lenses, causing distortion of light rays
3. SIZE OF CONCAVE MIRRORS	3. Limited by changes in temperature that distort large pieces of glass
4. ATMOSPHERIC DISTURBANCES	4. Turbulences in the air caused by winds, hot air rising
5. ATMOSPHERIC POLLUTION	5. Gases, humidity, and dust particles that filter out light rays and distort viewing
6. TRACKING DEVICES	6. Precision required in design of gears and motors used to lock a telescope on a fixed viewing point while the earth rotates on its axis
7. THE HUMAN EYE	7. Limited by light-gathering ability of lens in human eye and the blind spot where the optic nerve enters the eyeball
8. VIBRATIONS	8. The slightest amount of vibration distorts the image produced by a telescope. Tracking devices must be free from vibration. Telescope supports must be solid.
9. THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION WILL SOON PLACE TELESCOPES IN EARTH ORBIT	9. Discuss which limiting factors will be overcome by placing telescopes in space. Will any of the limiting factors increase?

GRADE 8
EARTH SCIENCE

UNIT: The Universe Overview
TOPIC: Methods of Investigation
OUTCOME: 34. Explain how spectroscopes are used.

Background

Spectroscopes are instruments that separate visible light into a pattern called the visible spectrum.

The visible spectrum occurs in nature when raindrops disperse light into colors because rays of sunlight pass through the raindrops creating a rainbow. Colors in the spectrum always appear in the same order or pattern: red, orange, yellow, green, blue, indigo, and violet. These colors travel in waves with red being the longest or lowest frequency and violet the shortest or highest frequency.

The activity is a teacher demonstration and should be conducted on a bright, sunny day.

Materials

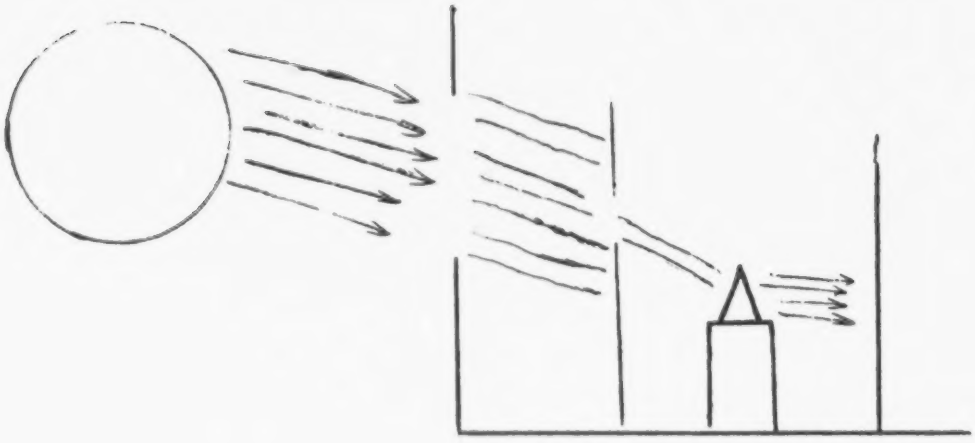
- Cardboard
- Prism
- Clipboard
- Colored pencils or crayons
- White paper

Procedures

1. Cut a narrow vertical slit in an 8 1/2 x 11 inch piece of cardboard so that a thin beam of sunlight shines through.

2. Place the cardboard and the prism so that a beam of light passes through the slit and strikes the prism.

3. Place the clipboard in front of the prism so that the spectrum is projected onto the white paper as shown below.



4. Allow students to observe the colors of the spectrum. Have students reproduce the spectrum on a sheet of paper using the colored pencils or crayons.

5. Discuss the bending of the light rays into waves of various lengths and the resulting colors.

GRADE 8
EARTH SCIENCE

UNIT: The Universe Overview
TOPIC: Methods of Investigation
OUTCOME: 35. Discuss radio telescopes, optical and nonoptical telescopes.
36. Explain the use of observatories.

Background

Astronomers actually spend little time peering through optical telescopes. Instead, cameras are attached to the eyepieces of telescopes that are set for time exposures, thereby enhancing the light-gathering capacity of the telescopes.

Astronomical observatories are stations consisting of one or more buildings that house telescopes and related equipment. The telescopes at a station or complex may consist of optical telescopes as well as radio telescopes that send and receive radio waves into space. The radio telescopes appear as large concave disc antennae.

This activity builds upon Outcomes 31, 32, and 33 dealing with limitation factors of optical telescopes. Students are asked to plan an observatory, justifying each decision in their plan.

Materials

- Handout, LIMITING FACTORS, from Outcomes 31, 32, and 33
- Handout, OBSERVATORY PLANNING

Procedures

1. Divide students into small groups and provide each group with a copy of both handouts.

2. Ask students to pretend that they have signed a contract to plan an observatory, based upon their knowledge of astronomy. Tell students that each decision made concerning the observatory should be noted in writing paired with justifications.

3. Instruct students to address each question on the Handout, OBSERVATORY PLANNING. When written plans are completed, allow the groups to make oral reports to the class describing their plans.

OBSERVATORY PLANNING
Handout

Indicate on this sheet how you have incorporated the following items in your plans for the observatory. Give a justification for each item.

ITEM	JUSTIFICATION (WHY?)
1. TYPE OF TELESCOPE(S)	
2. SIZE OF TELESCOPE(S)	
3. LOCATION OF OBSERVATORY	
4. CLIMATE IN AREA SELECTED	
5. HEATING AND COOLING SYSTEM INSIDE OBSERVATORY	
6. LIGHTING SYSTEM INSIDE OBSERVATORY	
7. ACCOMMODATIONS FOR ASTRONOMERS	
8. VISITATIONS BY MEMBERS OF THE PUBLIC	
9. OTHER CONSIDERATIONS (BUDGET)	

GRADE 8
EARTH SCIENCE

UNIT: The Universe Overview
TOPIC: Theories of Formation
OUTCOMES: 37. Define theories of formation of the universe.
38. Discuss and give evidence to support these theories.

Background

Currently there are two conflicting theories concerning the formation of the universe. Both theories are strictly theories and many scientists believe that much more will have to be learned about the universe before a more practical theory of formation can be proposed. Because of man's innate curiosity, theories are postulated in attempts to describe or explain the unknown.

Two modern theories are the "big-bang" theory and the "steady-state" theory. The "big-bang" theory takes the position that all matter in the universe once existed in the form of one mass. A titanic explosion occurred and expanding energy cooled into matter, forming galaxies and stars. Supporters of this theory take the position that astronomical observations reflect this idea that matter is rapidly expanding out into space and stars and galaxies are speeding away from each other.

Supporters of the "steady-state" theory take a reverse postion. This theory states that matter is continuously being formed, creating new stars and new galaxies. Critics of the theory hold that matter cannot be created in a void. Supporters believe the void is actually composed of hydrogen atoms, which serve as the basic building blocks for the universe.

Materials

- Reference sources identified by the teacher

Procedure

Select two capable students and request that each one research one of the theories in preparation for making a presentation in class to the students. Stipulate that the two students are not to read their reports in front of the class. Tell students to present with the aid of notes and simple visuals. Allow students three days to prepare a report.

GRADE 8
EARTH SCIENCE

UNIT: Stars
TOPIC: Structure
OUTCOME: 39. Discuss structure of stars.

Background

Prepare to discuss with students information about how spectroscopes are used to determine the structure of stars. Include the following information in your discussion: In order to determine the composition of stars, astronomers separate starlight into different wavelengths. To accomplish this task, astronomers pass starlight from a telescope through a spectroscope. A spectroscope is a special instrument used to breakup light that divides the starlight into spectrums. No two elements have the same spectrum. Astronomers can determine the composition of a star by examining how much light of each color is in the starlight and by the patterns of the spectral lines.

This activity helps students comprehend that a substance gives off a characteristic color when its elements are excited by heat. In this activity students will identify several compounds by their colors in a flame. This presentation helps students understand that scientists are able to identify the elements that make up stars by analyzing the colors.

This activity is suggested for one group of students at a time working under a teacher's supervision.

Prior to presenting the activity, fill each test tube about half full of water. In each test tube dissolve a different compound from those listed below. It is not necessary to measure the amount exactly, but make at least a 10% solution of each compound. Label each test tube with the name of the appropriate compound. Place a different wire loop in each test tube. On the chalkboard draw the following chart for students to copy.

COMPOUND COLORS IN FLAME TEST

Compound	Color
Copper chloride	
Sodium chloride	
Potassium chloride	
Barium chloride	
Lithium chloride	
Calcium chloride	

Materials

- Prism
- Bunsen burner
- Tweezers
- Wire loops (6) (may be made from nichrome, or toaster wire)
- Test tubes (6) (in a test tube holder)
- Water
- Paper towel
- Copper chloride
- Sodium chloride
- Potassium chloride
- Barium chloride
- Lithium chloride
- Calcium chloride
- Cobalt blue glass, if available
- Chalkboard

Procedures

1. Explain to students that visible light can be separated into a spectrum, or band of colors. Demonstrate this occurrence by holding a prism in direct sunlight to produce a spectrum.

2. Explain to students that different compounds, when subjected to heat, give off characteristic colors. Ask each student to prepare a chart similar to the one demonstrated on the chalkboard.

3. Ignite the burner. Near the burner, display the test tubes. Place a wire loop in each test tube.

4. Give students the following instructions:

NOTE: One student may perform all flame tests for a group, or students in the group may take turns performing flame tests.

- Take the wire loop from the test tube labeled Copper chloride. Hold the wire loop in the flame. Did the flame change color? (Yes). What color did you observe? (Blue-green).

- On your chart fill in the color you observed.

- Repeat this procedure and record observations for each compound. Be careful not to allow one compound to mix with or contaminate another compound. Be certain not to use the same wire loop for more than one compound.

NOTE: When testing the Potassium chloride, let students observe the flame through the cobalt blue glass, if available. This causes the pale lavender color to appear bright pink.

5. Let students compare notes on their results. Ask students if they were able to identify all compounds. Explain to students that with the unaided eye, it is difficult to distinguish between the red colors given off by lithium and calcium during a flame test. However, the red color for each element has a different wavelength. Thus, the

elements can be identified by a spectroscope, which separates the light from lithium and from calcium into their different wavelengths.

6. Ask students to explain how their observations relate to the study of the composition of stars. Explain to students that with the aid of a spectroscope, astronomers have discovered that most stars are composed mainly of hydrogen and helium with traces of most of the other elements found on earth.

COMPOUND COLORS IN FLAME TEST
Key

Compound	Color
Copper chloride	blue-green
Sodium chloride	yellow
Potassium chloride	pale lavender
Barium chloride	green
Lithium chloride	crimson red
Calcium chloride	orange-red

GRADE 8
EARTH SCIENCE

UNIT: Stars
TOPIC: Structure
OUTCOME: 40. Explain life cycle of stars.

Background

Because the life cycle of a typical star is believed to be billions of years long, there is no way to observe the entire life cycle of a star. However, the existence of different kinds of stars has helped scientists develop theories about the life histories of stars. This activity helps students understand the story that scientists believe best explains their observations and accounts for the formation of typical stars.

Materials

- Textbooks or reference books containing information about the life cycles of stars
- Construction paper: black, yellow, orange, red, white
- Markers
- Scissors
- Glue or tape
- Poster board or butcher paper
- Handout, LIFE CYCLE OF A STAR

Procedures

1. Explain to students that, like people, stars appear to have life cycles. Stars are probably born in great swirling clouds of gas and dust in space, exist for billions of years, and then die. Point out to students that there is no way to observe the entire life cycle of a star. However, scientists have studied the many different types of stars in the sky and believe that the following life story best explains their observations.

2. Divide students into groups. Give each group a Handout, LIFE CYCLE OF A STAR, and a pair of scissors. Ask students to cut the sentences on the handout apart along the dotted lines.

3. Ask each group to find the life cycle of a star in their textbook or a reference book. Have students use the information from the reference books to arrange the cut-apart sentences in correct order. Discuss student answers.

4. Direct each group to prepare a display illustrating the life cycle of a star using construction paper, markers, glue, and poster board or butcher paper. Tell each group to make construction paper shapes to represent the nebula, main sequence star, red giant, white dwarf, black dwarf, supernova, neutron star, and black hole. Have students arrange these representations into a sequence which represents the life cycle. Tell each group to include a sentence of explanation for each stage.

LIFE CYCLE OF A STAR
Handout

A cloud of gas and dust, called a nebula, exists in space.

Gravity causes the particles within the nebula to pull toward one another.

As the huge masses of gas and dust slowly pull together, they become very dense and hot. The new star begins to glow with a dull, red light.

The temperature in the core finally reaches millions of degrees, and the nuclear reaction called fusion begins.

The star becomes a stable, main sequence star, undergoing fusion for billions of years.

The star finally uses up most of the hydrogen in its core as a result of fusion.

The loss of hydrogen causes the star's core to collapse under its own gravity.

New nuclear reactions begin around the collapsed core and a new burst of energy is released.

The outer layers of the star expand greatly because of the increase in energy, but they grow cooler. The star now becomes a red giant.

The remaining fuel in the star is used up, and the star is no longer stable. It begins to shrink and expand in a series of pulses.

The outer layers of the star are flung off into space and the hot, dense core is exposed. The star is no longer undergoing nuclear fusion. It is now a white dwarf.

After billions of years, the star cools and becomes a black dwarf.

Some stars do not become white dwarfs. They die by undergoing a gigantic explosion called a supernova. These leave behind very dense neutron stars.

Some scientists believe the collapse of even larger stars could leave behind a black hole.

LIFE CYCLE OF A STAR
Key

NOTE: Discuss the information in parenthesis with students as you help them arrange their sentences in the order listed below.

1. A cloud of gas and dust, called a nebula, exists in space. (About three-fourths of the material in the nebula is hydrogen gas, and the remaining material is mostly helium, with small amounts of other elements.)

2. Gravity causes the particles within the nebula to pull toward one another. (As the particles get closer together, their attraction for each other increases. A mass of matter begins to grow within the nebula. As the mass increases, the pressure and temperature in the core region increases.)

3. As the huge masses of gas and dust slowly pull together, they become very dense and hot. The new star begins to glow with a dull, red light.

4. The temperature in the core finally reaches millions of degrees, and the nuclear reaction called fusion begins. (Fusion is the nuclear reaction that will provide energy for the star for the rest of its life cycle. It occurs when hydrogen is changed into helium by intense heat and pressure.)

5. The star becomes a stable, main sequence star, undergoing fusion for billions of years. (Students will learn more about main sequence stars in the activity for Outcome 41.)

6. The star finally uses up most of the hydrogen in its core as a result of fusion. (Until now the star has been stable because gravity, which causes it to shrink, is balanced by internal heat, which causes it to expand. The loss of hydrogen upsets this stability.)

7. The loss of hydrogen causes the star's core to collapse under its own gravity.

8. New nuclear reactions begin around the collapsed core and a new burst of energy is released.

9. The outer layers of the star expand greatly because of the increase in energy, but they grow cooler. The star now becomes a red giant. (Scientists think that our sun, now a main sequence star, will become a red giant in 4 or 5 billion years.)

10. The remaining fuel in the star is used up, and the star is no longer stable. It begins to shrink and expand in a series of pulses.

11. The outer layers of the star are flung off into space and the hot, dense core is exposed. The star is no longer undergoing nuclear fusion. It is now a white dwarf. (The heat produced by gravity

pulling its matter inward still provides some energy for the dying star.)

12. After billions of years, the star cools and becomes a black dwarf.

13. Some stars do not become white dwarfs. They die by undergoing a gigantic explosion called a supernova. These leave behind very dense neutron stars. (A spoonful of matter from a neutron star would weigh millions of tons on earth. Neutron stars are very small and are usually detected by radio waves.)

14. Some scientists believe the collapse of even larger stars could leave behind a black hole. (According to scientific theory, a black hole is created when gravity becomes so great at a point that space is bent in on itself. Nothing, including light, can escape from a black hole.)

GRADE 8
EARTH SCIENCE

UNIT: Stars
TOPIC: Structure
OUTCOME: 41. Describe the Hertzsprung-Russell diagram.
42. Explain the relationship of stars' brightness to temperature.

Background

The Hertzsprung-Russell diagram provides a way to compare stars, based upon their temperature, color, and brightness. In this activity students plot stars on a Hertzsprung-Russell graph to observe star patterns showing how a star's brightness, color, and temperature are related.

Prior to the activity, include instruction in the following:

- Stars differ in color. Some stars shine with a blue-white light while others produce a reddish light. By analyzing the light from these stars, scientists have learned that the color of a star's light is determined by its surface temperature. Stars with lower surface temperatures give off more red light. Hotter stars give off more blue light. The surface temperature of stars ranges from 3000°C to 50,000°C.

- The brightness of a star is the amount of light a star actually emits from its surface. The sun has a brightness of 1. If the brightness of a star is greater than 1, it is brighter than the sun. If the brightness of a star is less than 1, it is not as bright as the sun. The temperature of our sun is 5,300 degrees Celsius.

- Astronomers have discovered that plotting the surface temperature of stars against their brightness reveals an important pattern among stars. The Hertzsprung-Russell diagram illustrates this pattern.

Materials

- Colored pencils (red, orange, yellow, blue)
- Handout, HERTZSPRUNG-RUSSELL
- Handout, STAR DATA
- Pencils

Procedures

1. Review with students the relationship of a star's color and its surface temperature. Review the way a star's brightness is measured. (See Background section.) Explain to students that this activity involves making a HERTZSPRUNG-RUSSELL graph. Instruct students to mark stars on the graph by plotting the brightness of stars against their temperatures. This procedure provides an opportunity to discover an important pattern among the stars.

2. Give each student the Handout, STAR DATA, and the Handout, HERTZSPRUNG-RUSSELL. Explain that the Handout, STAR DATA, contains the names of 27 different stars, including our sun. For each star, the approximate temperature and brightness is given. Explain to students that the Temperature-Color Chart on the Handout, STAR DATA, helps decide which color to use for plotting each star. Ask students to examine the Handout, HERTZSPRUNG-RUSSELL. Explain to students that brightness is plotted along the vertical axis and temperature along the horizontal axis.

3. Help students find the location of our sun on the graph. Guide students in moving their pencils along the horizontal line at the bottom of the graph until they are slightly below 6,000 degrees on the temperature scale. Have students move their pencils up to 1 on the brightness scale and mark a circle for the sun.

4. Ask students to observe the Handout, STAR DATA, to find the surface temperature of the sun (5,300°C) and find out what color corresponds to that temperature by looking at the Temperature-Color Chart (yellow). Ask students to use a yellow pencil to color the circle representing the sun.

   NOTE: Star positions will appear better if students use a regular graphite pencil to outline the circle before filling in the star's color.

5. Ask students to plot the remaining data from the Handout, STAR DATA, on the Hertzsprung-Russell graph using a small circle to represent each star location. Explain to students that the location of some stars may be difficult to pinpoint exactly. Have students approximate these location points as nearly as possible. Give an example utilizing data of our sun.

6. After completing the diagram, ask students to look for patterns. Ask students to observe a fairly clear diagonal line of stars from one corner to another. Explain to students that these stars are called main sequence stars. Ask students to label this band of stars. Point out to students that these stars include a band of stars from very bright, hot stars (upper left corner) to very cool, dim stars (lower right corner). Ask students what the relationship between brightness and temperature is in this band of main sequence stars. (As temperature increases, so does brightness.)

7. Point out that some stars do not fit on the main sequence. Ask students to notice a group of very bright stars in the upper right corner. Surprisingly, these stars have relatively low surface temperatures. Ask students for ideas on how these stars can give off so much light energy if they have low surface temperatures. (Because they are very large in size--up to 500 times larger than the sun--they give off large amounts of energy.) Explain to students that astronomers call some of these stars giants and some supergiants. Call attention to the stars in the lower left part of the diagram. Although these stars are much hotter than the sun, they are dim because of their small size. Ask students to describe this kind of star. (white dwarfs) Have students label supergiants (brightest stars in the upper right-hand corner), giants (remaining stars in the upper right-hand corner), and white dwarfs.

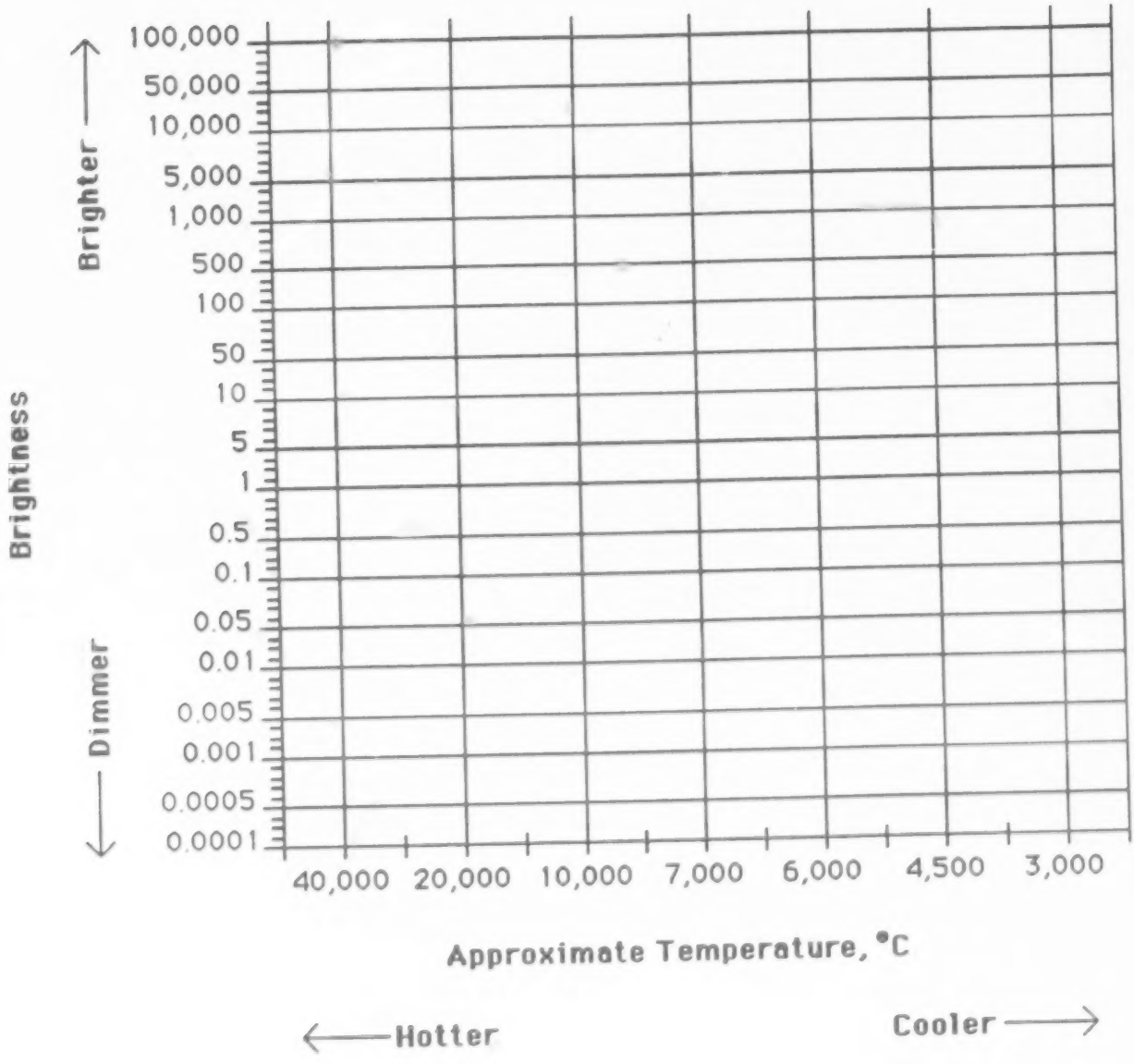
STAR DATA
Handout

Star Name	Approximate Temperature, °C	Brightness (Sun = 1)
Sun	5,300	1
Alpha Centauri A	5,500	1.3
Alpha Centauri B	3,900	0.36
Barnard's Star	2,500	0.0004
Lalande 21185	2,900	0.005
Sirius A	10,100	23
Sirius B	10,400	0.008
Ross 248	2,400	0.0001
61 Cygni A	3,900	0.08
61 Cygni B	3,600	0.04
Procyon A	6,200	7.6
Procyon B	7,100	0.0005
Epsilon Indi	3,900	0.13
Canopus	7,100	1,500
Arcturus	4,200	90
Vega	10,400	60
Capella	5,600	150
Rigel	11,500	40,000
Betelgeuse	2,900	17,000
Achemar	14,000	200
Beta Centauri	21,000	3,300
Altair	7,700	10
Aldebaran	3,900	90
Spica	21,000	1,900
Antares	3,100	4,400
Deneb	9,900	40,000
Beta Crucis	22,000	6,000

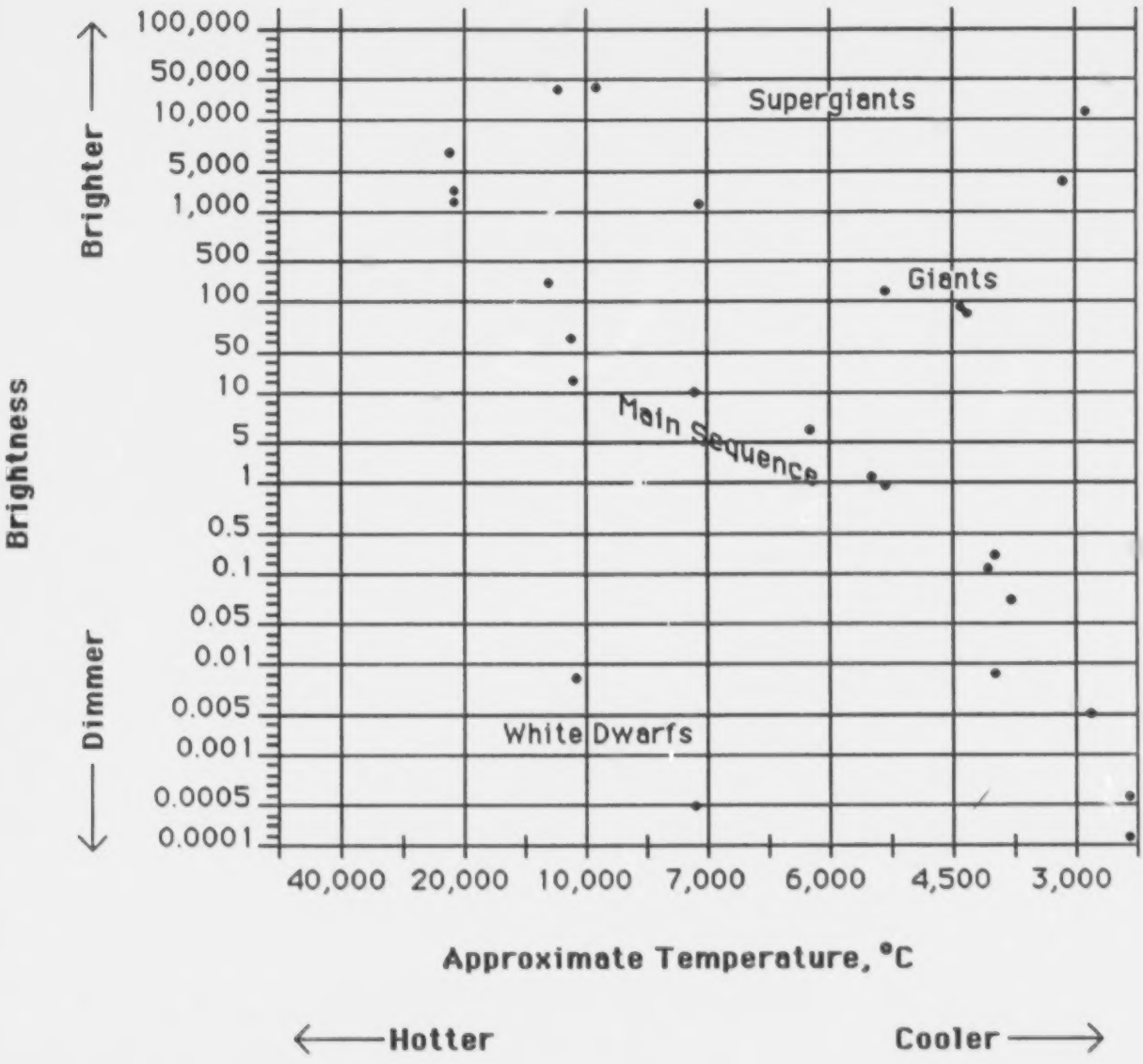
Temperature-Color
Chart

Temperature °C	Color
up to 3,000	red
3,000-5,000	orange-red
5,000-6,000	yellow
6,000-7,500	blue-white
above 7,500	blue

HERTZSPRUNG-RUSSELL HANDOUT



Answer Key for Hertzsprung-Russell Handout



GRADE 8
EARTH SCIENCE

UNIT: Stars
TOPIC: Constellations
OUTCOME: 43. Explain how constellations are named.

Background

Present the following information to students during this activity:
A constellation is a group of stars in a definite region of the sky. The pattern of these stars in the night sky has changed very little during the last several thousand years. During that time, people from every culture have grouped stars into constellations, or patterns that suggest "pictures." Many of the pictures people imagined in the constellations were based on stories about their gods or on mythology. Different cultures grouped stars into constellations, and each culture gave these constellations different names. To end the confusion, in 1928 the International Astronomical Union fixed the boundaries and the names of 88 constellations. The names of all constellations are now given in Latin.

Some familiar constellations are Andromeda (the Chained Princess), Perseus (the Hero), Cassiopeia (the Queen), and Cepheus (the King). According to Greek mythology, Andromeda was the daughter of Queen Cassiopeia and King Cepheus. Andromeda was very beautiful, and her mother often bragged about her beauty. The gods became angry about the bragging and chained Andromeda to some rocks near the sea to be eaten by sea monsters. Perseus, the son of the god Zeus, rushed in and saved Andromeda.

Materials

- Handout, PICTURE OF CONSTELLATION LEO
- Handout, CONSTELLATION PATTERNS
- Reference books with information about familiar constellations
- Unlined paper
- Black markers

Procedures

1. Ask students to verbalize their current knowledge about constellations. Discuss the material in the Background with students. Tell students the myth in the Background is an example of the stories ancient cultures told about constellations.

2. Show students the picture of Leo from the Handout, PICTURE OF CONSTELLATION LEO. Ask students to ascertain why ancient cultures pictured this group of stars as a lion. Point out that some constellations are difficult to picture.

3. Divide students into groups of three or four and give each group unlined paper, several markers, and a copy of the Handout, CONSTELLATION PATTERNS.

4. Direct each group to choose one constellation from the Handout, CONSTELLATION PATTERNS, draw the constellation on the unlined paper, and decide what "picture" they imagine in the constellation.

5. When each group has decided on a "picture" to accompany its constellation, direct the groups to draw the "picture" on the unlined paper just as Leo is drawn on the sample sheet.

6. Have each group write a short myth about the constellation they have drawn.

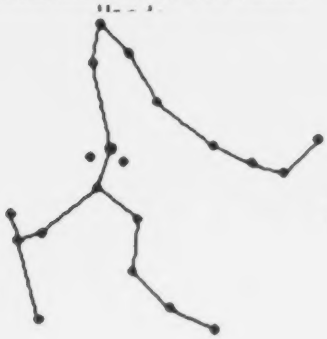
7. Give each group one or more books containing material about constellations and direct them to research information about the constellation they have chosen and illustrated. Ask students to find the scientific name of the constellation and what mythical figure it represents as well as any other information.

8. When all groups have completed the activity, ask each group to share with the class their "pictures," myths they have written, and information provided by their research.

PICTURE OF CONSTELLATION LEO
Handout

CONSTELLATION PATTERNS

1.



2.

3.

4.

5.

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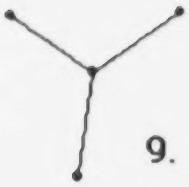
7.

8.



9.

CONSTELLATION PATTERNS

Key

1. Camelopardalis
2. Perseus
3. Pices
4. Bootes
5. Ursa Major (Big Dipper)
6. Canis Major
7. Virgo
8. Draco
9. Cancer

GRADE 8
EARTH SCIENCE

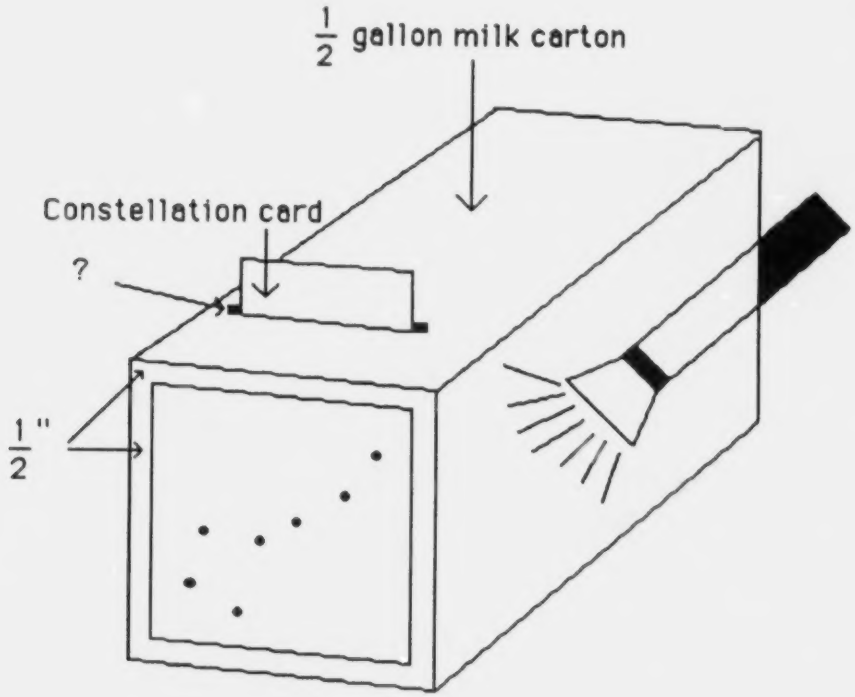
UNIT: Stars
TOPIC: Constellations
OUTCOME: 44. Identify the constellations.

Background

Before beginning this activity, students should have some knowledge concerning constellations and the origin of constellations' names. The activity will help students understand and recognize the patterns of common constellations. Two or three class periods should be scheduled for the activity.

Prepare milk carton viewers in advance of the activity. To make milk carton viewers, use empty half-gallon milk cartons. Cut a square hole in the bottom of each carton leaving a half-inch margin on all sides. Cut a slit all the way across one side of the carton approximately one inch from the bottom. Widen the slit enough so that a piece of construction paper can be easily inserted and removed.

MILK CARTON VIEWER



Materials

- Milk carton viewers
- Black construction paper
- Pencils
- Flashlights
- Scissors
- Handout, CONSTELLATION PATTERN

Procedures

1. Divide students into groups and equip each group with a milk carton viewer, flashlight, scissors, black construction paper, sharp pencils, and a copy of the Handout, CONSTELLATION PATTERN.

2. Direct each group to cut 24 cards from black construction paper, each card being 1/4 inch narrower than the slit in the viewer and long enough to be inserted and easily withdrawn from the slit.

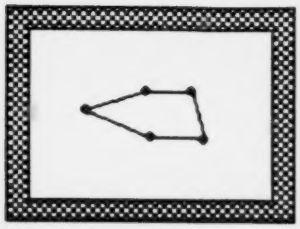
3. Have each group use the construction paper cards to make a model of each constellation shown on the Handout, CONSTELLATION PATTERN, by using a pencil point to make a hole for each star of the constellation.

4. Have students label each card with the name of the constellation it represents.

5. When all groups have completed their cards, direct students to view the cards one at a time by inserting a card through the slit in the milk carton viewer, positioning the flashlight inside the viewer so that it shines through the holes in the card, and turning the flashlight on.

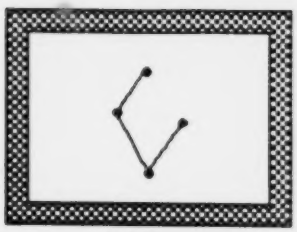
6. Have each group study the cards until students can recognize and name the various constellations.

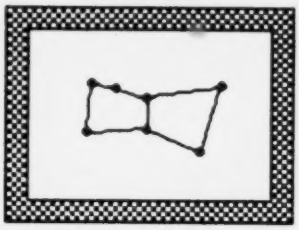
CONSTELLATION PATTERN
Handout


Cepheus

Cassiopeia

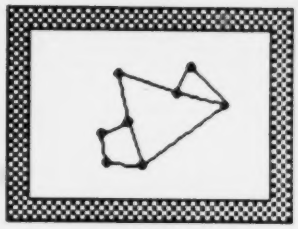
Leo


Libra


Hercules

Aquarius

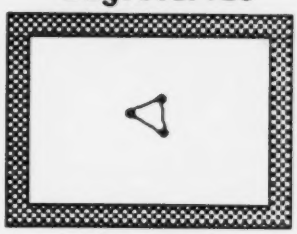
Lepus


Sagittarius

Cancer

Ursa Major

Ursa Minor


Columba

Gemini

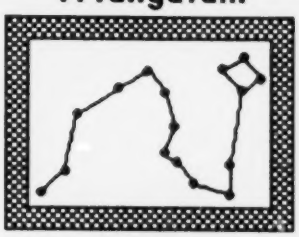
Cetus

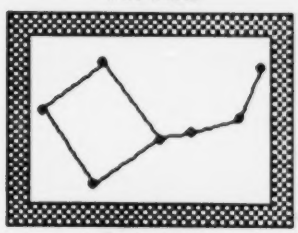
Triangulum

Aries

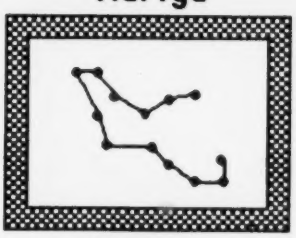
Delphinus

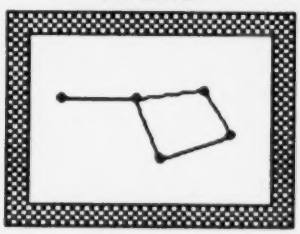
Auriga


Draco


Pegasus

Andromeda


Persus


Corvus

Virgo

GRADE 8
EARTH SCIENCE

UNIT: Stars
TOPIC: Constellations
OUTCOME: 44. Identify the constellations.

Background

This activity should follow the previous outcome 44 in which students made constellation cards.

Before beginning the activity, use the appropriate sky map to familiarize students with the constellations visible in the night sky during this time of year and the area of the sky in which each constellation is located. Constellations may be pinpointed even more accurately by using the sky map found in each monthly issue of Astronomy. In the northern hemisphere, five constellations are always visible in the night sky: Ursa Major (Big Dipper), Ursa Minor (Little Dipper), Cepheus (the King), Cassiopeia (the Queen), and Drago (the Dragon). Polaris (the North Star) is located at the tip of the Little Dipper's handle and is used by navigators to find the direction north. All constellations change positions as the earth rotates during the night. For this reason, many constellations may have different positions from those shown on the sky map.

The Fall Sky Map should be used during the months of September, October, and November, the Winter Sky Map during December, January, and February, and the Spring Sky Map during March, April and May. The edge of a map is the horizon. The center of the map is directly overhead. It should be noted that planets may appear to be bright stars.

Materials

- Handout, FALL SKY MAP
- Handout, SPRING SKY MAP
- Handout, WINTER SKY MAP
- Red cellophane
- Flashlights

Procedures

1. Give each student the appropriate sky map. Ask students if they recognize any of the constellations on the map. Ask students how the map can be used.

2. Have students identify the constellations on the map by writing constellation names in the appropriate spaces. Discuss answers with students.

3. Tell students to locate the constellations on the next clear night using the maps. Give students the following directions:

a. Choose a clear night with few clouds.

b. To ensure darkness, wait until at least 8:00 p.m. during winter months and later during fall and spring months.

c. Eliminate as much artificial light as possible from the viewing area.

d. Hold the sky map vertically. Turn the map so that the direction faced is at the bottom of the map.

e. Locate the Big Dipper, Little Dipper, Cassiopeia, and Orion first. Use these constellations as reference points.

f. When using the flashlight outside, cover the light with red cellophane. This process enables your eyes to adjust to the darkness each time the flashlight is used.

g. After locating the constellations, answer the following questions on a separate sheet of paper:

Which constellations did you find most easily?

Which constellations were you unable to find?

Were you able to find Polaris? Where is it located?

Which constellations contain especially bright stars?

How can these bright stars be of help?

4. After the assignment has been completed by all students, share findings and answers in classroom discussions.

SKY MAP QUESTIONS
Key

After locating constellations, answer the following questions on a separate sheet of paper:

1. Which constellations did you find most easily? (Answers may vary, but answers will probably include the Big Dipper, Little Dipper, Orion, and Cassiopeia.)

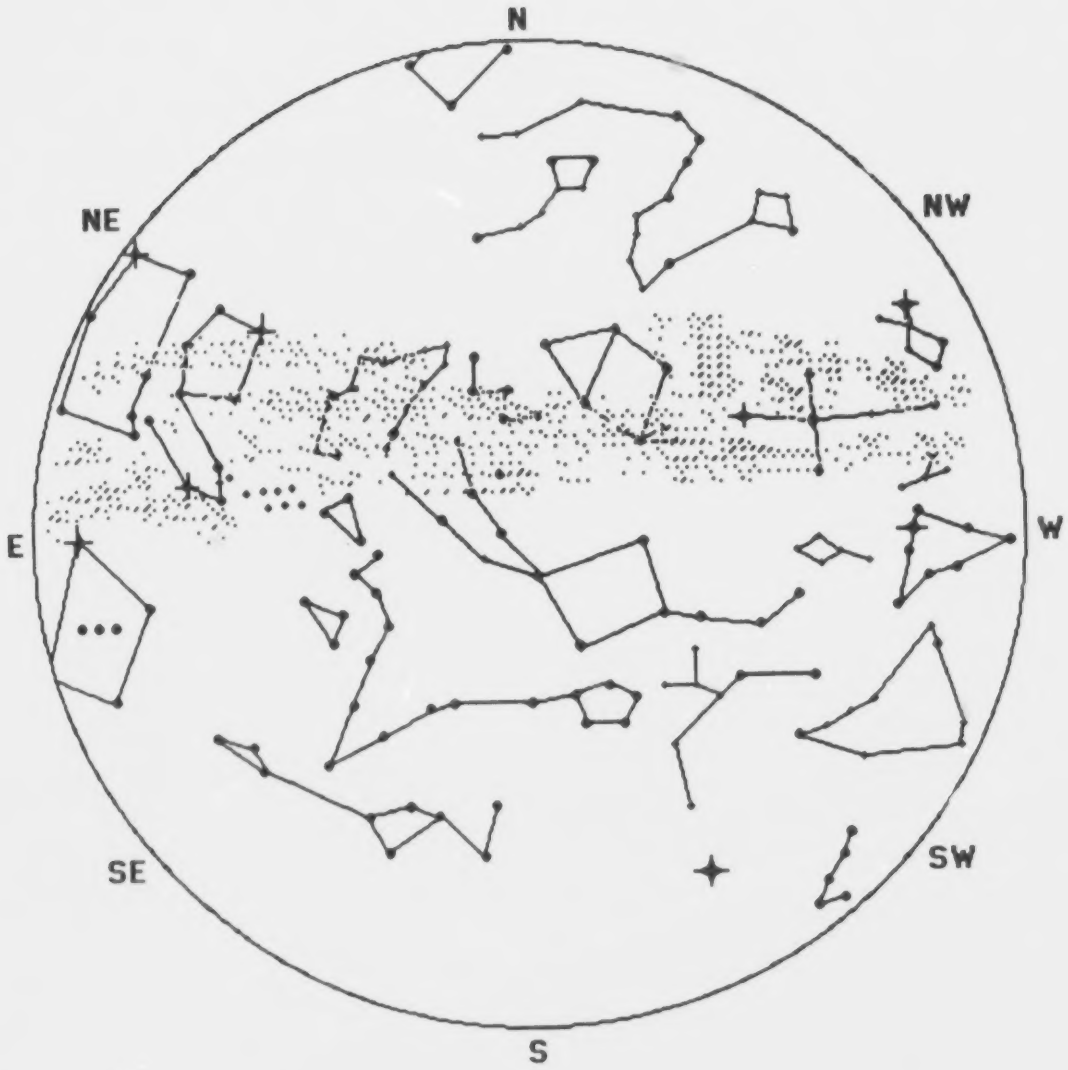
2. Which constellations were you unable to find? (Answers may vary. Point out that the constellations change as the earth rotates. During the night some constellations appear in the east and others disappear in the west. Some constellations may not have been visible during certain viewing periods and may become visible closer to dawn.)

3. Were you able to locate Polaris? Where is it located? (Polaris is located at the tip of the handle of the Little Dipper.)

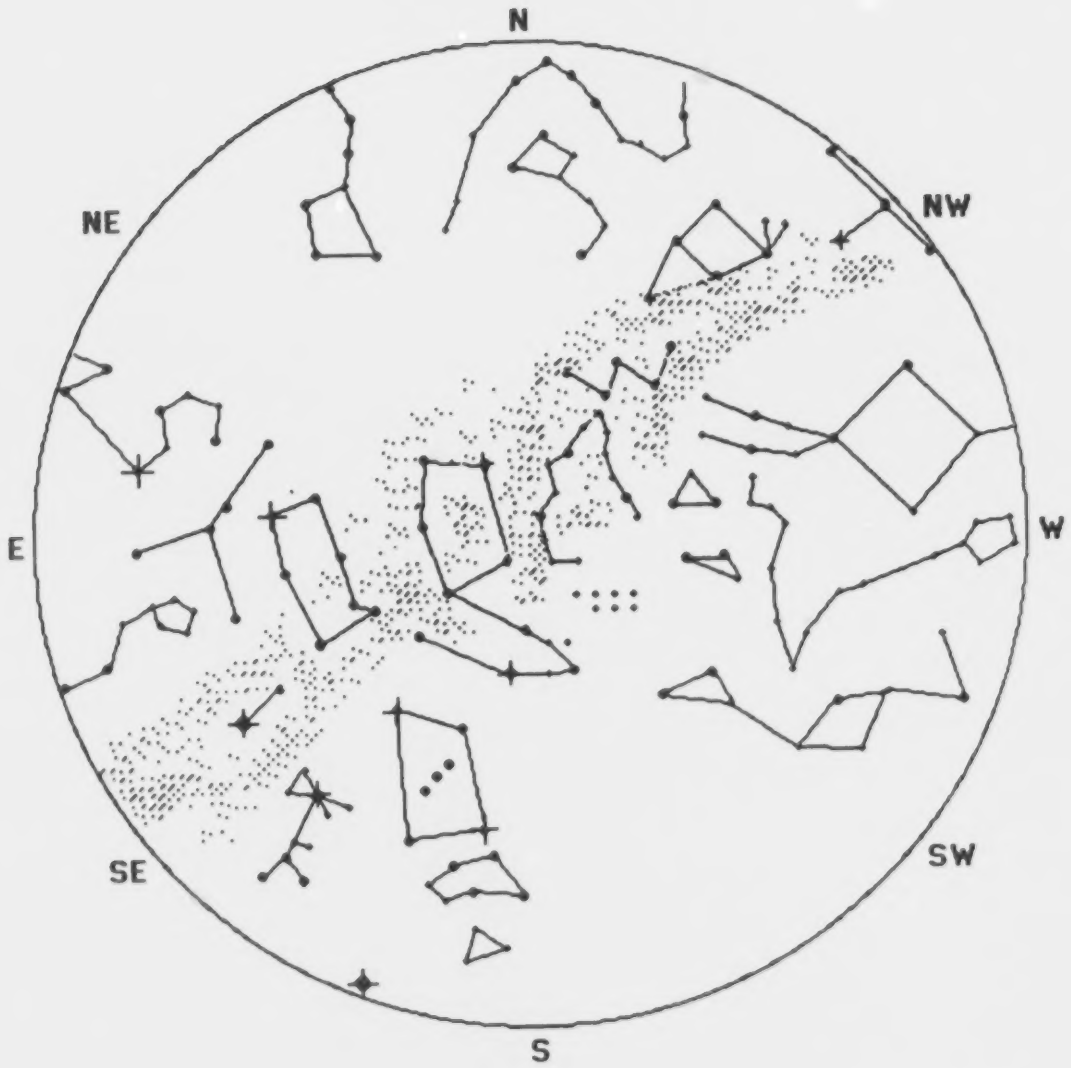
4. Which constellations contain especially bright stars? (Answers may include Orion, Gemini, Auriga, Taurus, Cygnus, and Aquila in the Fall sky; Leo, Cygnus, Canis Major, Canis Minor, Orion, Gemini, Taurus, and Auriga in the Winter sky; and Cygnus, Bootes, Virgo, Scorpius, Lyra, Leo, Gemini, and Canis Minor in the Spring sky.)

5. How can these bright stars be of help? (They can provide reference points for locating other stars in the constellation.)

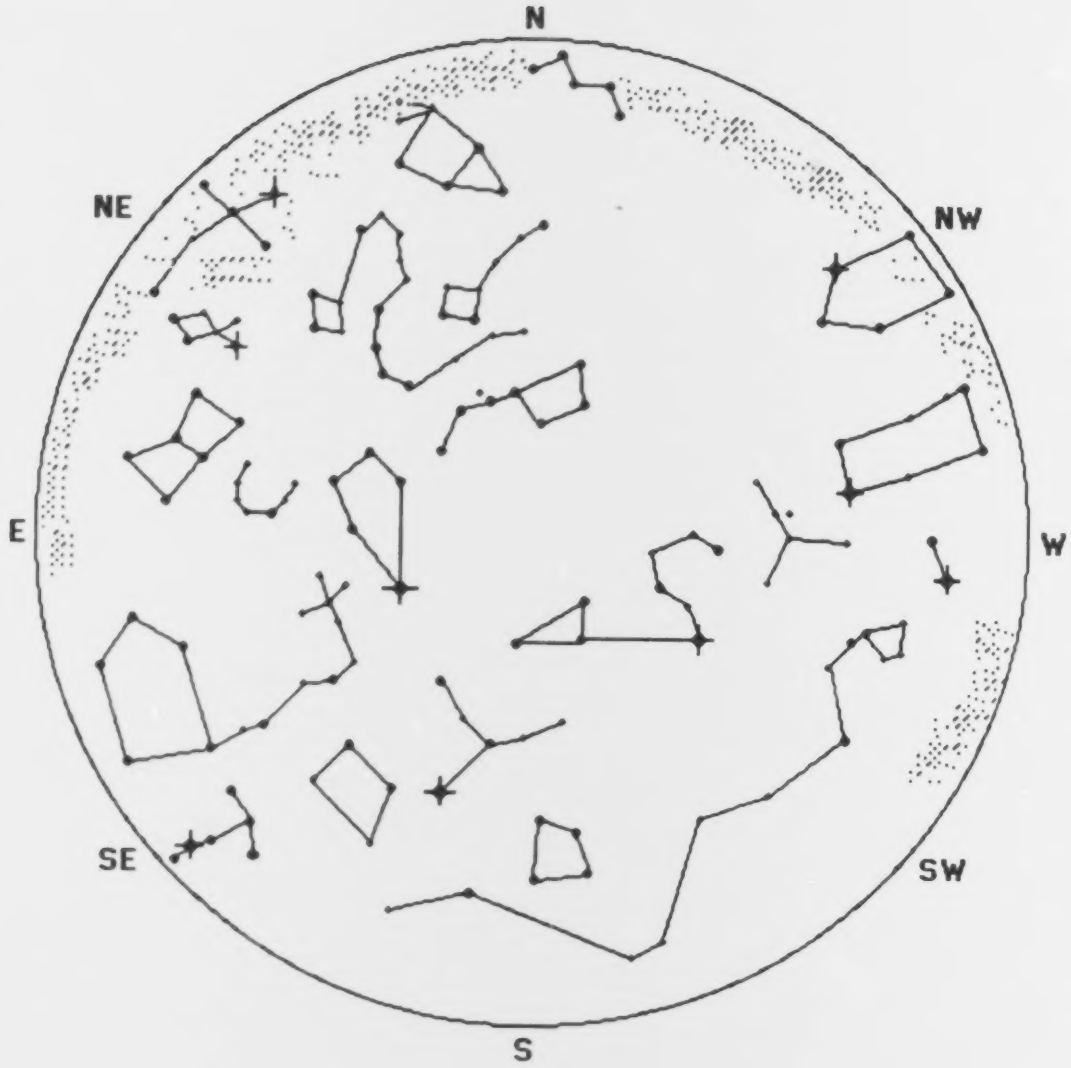
FALL SKY MAP
Handout



WINTER SKY MAP
Handout



SPRING SKY MAP
Handout



GRADE 8
EARTH SCIENCE

UNIT: Our Solar System
TOPIC: The Sun
OUTCOME: 45. Describe major features of the sun.

Background

Before presenting this activity, discuss solar features, including solar flares and sunspots. Explain that solar flares or storms, as they are often called, increase and decrease in intensity from time to time. Sunspot activity seems to increase on a regular eleven year cycle. Because of the intense brightness of the sun, special instruments are needed for studying solar features. This activity helps students observe sunspots safely. Caution students never to look directly at the sun under any circumstances.

The timelines for this activity take about five to ten minutes per day for one week. Groups of 2 or 3 students may work with the telescope or binoculars.

Two plans are described for safely observing sunspots. Use Plan 1 if a telescope is available. Use Plan 2 if no telescope is available (students use binoculars).

PLAN 1

Materials

- Telescope
- Tripod or stand
- Heavy posterboard or cardboard
- Scissors
- Plain white paper
- Clipboard
- Dark pencil or pen

Procedures

1. Use a window in the classroom that faces the sun for this activity. Place a table next to the window.

2. Place the telescope on the tripod or stand. Position the telescope in the window to face the sun.

3. Cut a hole in the center of a square of posterboard or cardboard that is large enough to allow the posterboard to fit around the telescope. Place the posterboard around the telescope as a sun shield. (See illustration.)

4. Prior to beginning the activity, discuss with students the dangers of looking directly at the sun. Explain to students that the sun's

intense brightness can cause serious and permanent eye damage. Explain to students that this activity provides an opportunity for sunspots to be observed by looking at an image of the sun reflected on a piece of paper.

5. Give students the following instructions:

   - Fasten a piece of plain, white paper to the clipboard. Hold the clipboard upright behind the eyepiece of the telescope with the bottom edge resting on the table. Move the clipboard back and forth until the largest possible image of the sun shows on the paper. Focus the lens until the image is clear and distinct.

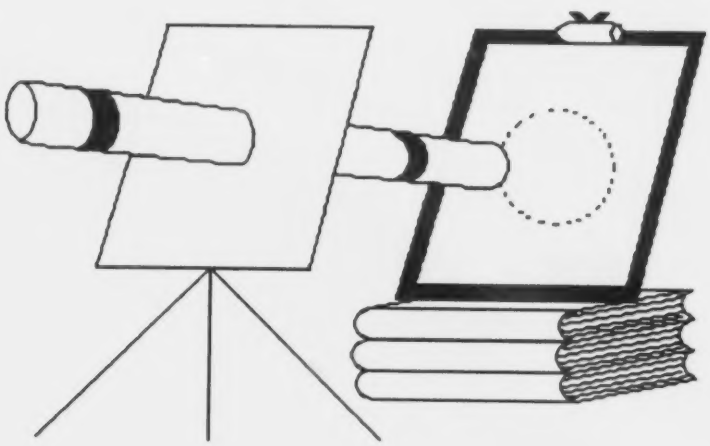
     NOTE: If the table is too low, stack books underneath the clipboard. The books should support the clipboard while the sun's image is reflected.

   - Look for sunspots on the sun's image. These will appear as dark spots. At times sunspots may not be visible. However, usually several can be observed.

   - Let one person hold the clipboard steady while another traces the outline of the sun's image on paper. Be sure to trace and shade any sunspots. Label the drawing Day 1 and keep it for later reference.

   - Leave the telescope in position to facilitate observing and drawing sunspots every day for a week. Each day, label the drawing with the correct number of the day. At the end of a week, compare the sunspots on each day's drawing. Observe the shape of the sunspots to see if they remained the same each day and stayed in the same location.

     NOTE: Large sunspots may appear to have the same shape for several days in a row. However, the sunspots may break up and disappear. Sunspots may seem to move across the sun's surface due to the sun's rotation.



PLAN 2

Materials

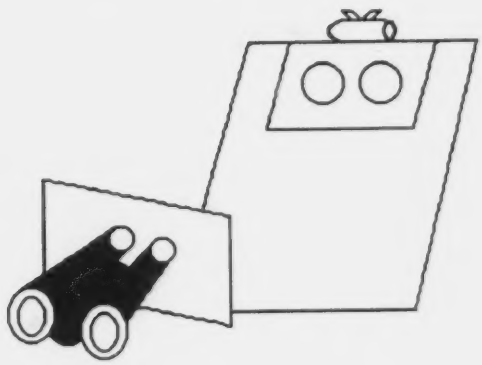
- Binoculars
- Tripod or stand
- Posterboard or cardboard
- Scissors
- Clipboard
- 3x5 cards

Procedures

Follow the same directions as for Plan 1 with the following modifications:

- Cut a sun shield from cardboard or posterboard so that it fits at the front of the eyepiece section of the binoculars. (See illustration.)

- Since the sun's image will be smaller using the binoculars than with the telescope, have students trace the sun's image on a 3x5 card. Tell students to turn the cards in the same direction each day when drawing the sun's image. At the end of the week, have students arrange the cards into a flip booklet to observe any sunspot movement.



- Again caution students never to look directly at the sun through binoculars or telescopes. It may be advisable to place a caution sign near the displays to constantly remind students of the potential for serious eye damage.

GRADE 8
EARTH SCIENCE

UNIT: Our Solar System
TOPIC: The Sun
OUTCOMES: 46. Relate distance between the planets and the sun's energy.
49. Explain the organizational pattern of the planets in the solar system.

Background

This activity helps students use temperature as an indicator of how the distance between a planet and the sun affects the amount of solar energy received by the planet. The average distance of the earth from the sun is approximately 93 million miles. This distance is termed one astronomical unit or one A. U. To give students an idea of the relative distances of planets from the sun, write the following chart on the chalkboard before beginning the activity.

PLANET	DISTANCE FROM THE SUN (A. U.)	DISTANCE IN INCHES
Mercury	0.4	3/8
Venus	0.7	3/4
Earth	1.0	1.0
Mars	1.5	1 1/2
Jupiter	5.2	5 1/4
Saturn	9.5	9 1/2
Uranus	19.5	19 1/2
Neptune	30.1	30 1/8
Pluto	39.4	39 3/8

Materials

- Ice cubes, approximately the same size and shape
- Ziplock sandwich bags (6)
- Infrared heat lamp, 250 watts
- Ruler
- Graduated cylinder
- Thermometers (6) (optional)
- Handout, ENERGY RECORD
- Chalkboard

Procedures

1. Call students' attention to the chart on the chalkboard giving the planets' relative distances from the sun. Help students understand the scale of the chart and how distances are obtained. (Use information from the activity for Outcome 49.)

2. Have students explain how the distance from the sun might affect the amount of solar energy that reaches a planet. Tell students this activity helps test their explanations.

3. Select student volunteers to locate the heat lamp near the edge of a table as shown in the diagram at the end of this activity. Explain to students to stand behind the lamp. At no time should students face the lamp or look directly into the lamp.

4. Before turning on the heat lamp, have student volunteers place one ice cube in each sandwich bag. Call attention to the chart on the chalkboard that gives the planets' relative distances from the sun. Explain that the four planets nearest the sun--Mercury, Venus, Earth, and Mars--are called the inner planets. Have students place a bag with an ice cube about one inch from the heat lamp to represent the distance of the inner planets from the sun. Have students place a second bag containing an ice cube about 5 inches from the lamp. Explain to students that this will represent the distance of Jupiter. Have students place bags containing the other ice cubes at distances of 9, 19, 30, and 39 inches from the heat lamp. Ask students which planets the bags represent. (Saturn, Uranus, Neptune, and Pluto.)

   Have students place a thermometer near each ice cube location to measure the amount of heat.

5. Turn on the heat lamp. Let the heat lamp shine for about 15 minutes or until the ice cubes representing the inner planets melt.

6. Give each student a Handout, ENERGY RECORD. Turn off the heat lamp. If thermometers were used, ask students to first record on their handouts the temperature at each ice cube location. Ask students to use the graduated cylinder to measure and record the amount of water in each bag.

   NOTE: Let different students be responsible for measuring temperature and water amounts at each location. Ask students to work as quickly as possible. Have students place their information on the chalkboard and complete the handout sheet.

7. Ask students to examine their completed handouts. If thermometers were used, ask students what was observed concerning temperature. (The temperature increased with nearness to the lamp.) Ask students what was observed about the amount of water collected at each ice cube location. (More water was collected from bags nearer the lamp than from bags farther from the lamp.) Ask students what conclusions can be drawn from this evidence. (More ice melted in the bags nearer the lamp. This evidence shows that bags nearer the lamp received more

heat.) Ask students if this activity demonstrates the correctness of their original explanation. (Yes. This activity shows that normally, the nearer an object is to an energy source such as the sun, the more heat will be received. Point out that other factors influence a planet's temperature. The planet Venus has a hotter average temperature than Mercury even though Mercury is closer to the sun. This is due to Venus's thick atmosphere which causes a buildup of heat at the planet surface.)

ENERGY RECORD
Handout

Distance from Sun	Amount of water	Temperature (optional)
1 inch (Inner planets)		
5 inches (Jupiter)		
9 inches (Saturn)		
19 inches (Uranus)		
30 inches (Neptune)		
39 inches (Pluto)		

GRADE 8
EARTH SCIENCE

UNIT: Our Solar System
TOPIC: The Sun
OUTCOME: 47. Explain source of the sun's energy.

Background

Prior to presenting the activity, review with students the basic structure of an atom, including protons, electrons, and neutrons. During the activity, review with students the process of nuclear fusion which scientists believe produces the sun's energy. Include the following information: Hydrogen is the simplest kind of atom, consisting of a single proton and no neutron. The sun contains more hydrogen atoms than any other kind of atom. Near the center of the sun, where temperature and pressure are high, hydrogen atoms lose their electrons leaving only the proton nucleus. In the process of fusion, the hydrogen nuclei join together to form helium nuclei. This process involves a three-step process.

1. Two protons collide and join together. One of these protons then changes into a neutron. This process forms heavy hydrogen, or deuterium.

2. The deuterium nucleus joins with another proton to form light helium.

3. Two light helium nuclei combine. The resulting cluster forms a helium nucleus with two protons left over. The matter in the two leftover protons is changed into energy.

Materials

- Small paper circles (1 inch diameter)
- Plain paper
- Chalkboard

Procedures

1. Review with students information from the Background section of this activity.

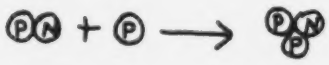
2. Explain that students can prepare a model to help understand the steps in the fusion process. Give each student 12 paper circles.

3. Ask students to count out eight circles and place a large "P" in the center of each circle. Ask students to place a large "N" in the center of the remaining four circles. Explain to students that circles with a "P" will represent protons and circles with an "N" will represent neutrons.

4. Ask a student volunteer to explain the first step of the fusion process. (Two protons collide and join together. One of these protons then changes into a neutron. This forms heavy hydrogen, or

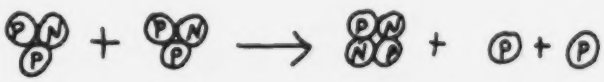
deuterium.) Have students use the appropriate circles to illustrate this step. Tell students to place the circles on a sheet of paper and draw a plus-mark (+) to indicate that protons are joining. Explain to students to use an arrow to indicate what is formed by the joining process. Draw the following diagram on the chalkboard so that students can check their answers.

5. Ask a student volunteer to explain step two of the fusion process. (The deuterium nucleus joins with another proton to form light helium.) Have students use the appropriate circles to illustrate this step in the same manner as step one. Draw the following illustration on the chalkboard so that students can check their answers.



6. Ask a student volunteer to explain step three of the fusion process. (Two light helium nuclei combine. The resulting cluster forms a helium nucleus with two protons left over.)

   NOTE: Students will need to use the circles from steps one and two to illustrate step three. Draw the following illustration on the chalkboard so that students can check their answers.



7. Have students repeat procedures 4, 5, and 6 to help understand steps in the nuclear fusion reaction. At the conclusion of the activity, explain to students that every second the sun changes more than 600 million tons of hydrogen nuclei into helium nuclei. Explain to students that this is how the sun produces energy. Tell students that fusion at this rate can continue for another 5 billion years.

GRADE 8
EARTH SCIENCE

UNIT: Our Solar System
TOPIC: The Planets
OUTCOME: 48. Identify the planets.

Background

This activity introduces students to the names and relative sizes of the planets in our Solar System.

Materials

- Scissors
- Markers
- Glue or scotch tape
- Construction paper or paper plates, 9 inches in diameter
- Rulers
- Chalkboard

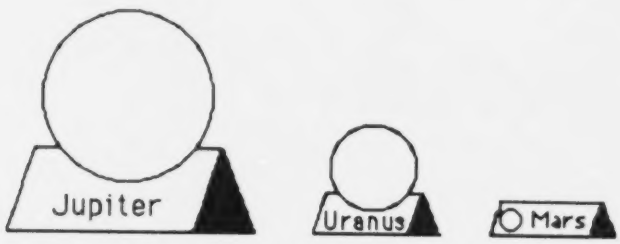
Procedures

1. Divide students into groups and equip each group with scissors, glue or scotch tape, marker, paper plates, and several pieces of construction paper.

2. Have each group draw circles of the following sizes on the paper plates:

   Circle #1 -- 1/3 inch in diameter
   Circle #2 -- 3/4 inch in diameter
   Circle #3 -- 7/8 inch in diameter
   Circle #4 -- 1/2 inch in diameter
   Circle #5 -- 9 inches in diameter
   Circle #6 -- 7 1/2 inches in diameter
   Circle #7 -- 3 inches in diameter
   Circle #8 -- 2 7/8 inches in diameter
   Circle #9 -- 1/3 inch in diameter

3. Have each group cut out their circles and tape or glue each circle on a stand made by folding a piece of construction paper as shown in the illustration.



4. Write the following information on the chalkboard:

NAME OF PLANET	DIAMETER IN MILES
1. Mercury	3,030
2. Venus	7,550
3. Earth	7,927
4. Mars	4,220
5. Jupiter	88,700
6. Saturn	75,100
7. Uranus	29,000
8. Neptune	28,000
9. Pluto	3,600

5. Explain to students that each circle represents a different planet and that the relative sizes of the circles represent the approximate sizes of the planets.

6. Have students use the information on the chalkboard and write a name on each circle.

7. Tell students to save the circles for use with Outcome 49 concerning distance of each planet from the sun.

Variation

Have students bring objects that represent the relative sizes of the planets. Suggested items might include a pea for Mercury, a walnut for Venus, a larger walnut for Earth, a bean for Mars, a nine-inch cabbage for Jupiter, an eight-inch cabbage for Saturn, an orange for Uranus, a larger orange for Neptune, and a bean for Pluto.

ANSWER KEY FOR CIRCLES

1.	Mercury	1/3 inch
2.	Venus	3/4 inch
3.	Earth	7/8 inch
4.	Mars	1/2 inch
5.	Jupiter	9 inches
6.	Saturn	7 1/2 inches
7.	Uranus	3 inches
8.	Neptune	2 7/8 inches
9.	Pluto	1/3 inch

GRADE 8
EARTH SCIENCE

UNIT: Our Solar System
TOPIC: The Planets
OUTCOME: 49. Explain the organizational pattern of the planets in the solar system.

Background:

In this activity students construct a model to help understand the order and relative distances of the planets from the sun. Before beginning the activity, discuss astronomical units or A.U. with the students.

The average distance of the earth from the sun is approximately 93 million miles. Astronomers call this distance one astronomical unit or one A.U. Astronomical units are used to measure distances within our solar system. Astronomers use astronomical units to give ratios, or relative distances, between planets.

Materials

- Adding machine tape (40 meters long)
- Meter stick
- Planet models from Outcome 48
- Markers
- Glue or tape
- Chalkboard

Procedures

1. Write the following chart on the chalkboard before beginning the activity.

PLANET	DISTANCE FROM THE SUN (A.U.)	DISTANCE IN INCHES
Mercury	0.4	3/8
Venus	0.7	3/4
Earth	1.0	1.0
Mars	1.5	1 1/2
Jupiter	5.2	5 1/4
Saturn	9.5	9 1/2
Uranus	19.5	19 1/2
Neptune	30.1	30 1/8
Pluto	39.4	39 3/8

2. Discuss the chart with students. Tell students that drawings in books may not depict correct distances between planets but this activity will allow a visualization of the distances more realistically.

3. Divide students into the same groups used in Outcome 48. Give each group a roll of adding machine tape, meter stick, and marker.

4. Have each group write the word SUN at the beginning of the roll of adding machine tape.

5. Using the chart on the chalkboard, have each group measure the distance from the sun to the planet Mercury (3/8 inch) and write the word MERCURY at this position on the tape. Have each group continue measuring the distance from each planet to the sun and writing the names of the planets in the appropriate places on the tape until all planets have been recorded.

6. Instruct each group to tear off the tape just beyond the point marked for Pluto.

7. If classroom space permits, have the groups stretch and tape the tapes across the chalkboard or a wall. Compare tapes for accuracy.

8. If classroom space is not adequate to stretch out tapes, utilize the walls in the school hallway. Title the project HOW FAR IS THE SUN?

Variation

Have groups tape or glue their planets from Outcome 48 in the correct places on the tape. Discuss relative sizes of the planets and relative distances from the sun.

GRADE 8
EARTH SCIENCE

UNIT: Our Solar System
TOPIC: The Planets
OUTCOME: 50. Describe features of each planet.

Background

This activity requires approximately three days. Before beginning the activity, prepare a folder of material on each planet. In each folder place any available up-to-date information about the planet.

Include current newspaper and magazine articles, information from the National Aeronautics and Space Administration (NASA), and information photocopied from encyclopedias or books whose copyright dates are later than 1986. If possible, select books from the school library which contain pertinent information.

On the chalkboard write FACTS ABOUT PLANETS and beneath the title list the terms: size, distance from the sun, period of revolution, period of rotation, temperature, composition, atmosphere, surface features, moons, rings (if any), distinguishing features, and other information.

Materials

- Folders containing current information about planets
- Reference books, if available
- Poster board
- Markers
- Scissors
- Glue
- Chalkboard

Procedures

Days 1-2

1. Write the names of the nine planets on slips of paper. Place the names of the planets in a box.

2. Divide the students into nine groups and have each group select the name of a planet.

3. Give each group the folder containing information about their selected planet. Explain to students that they are to spend two days collecting and assembling information about the planet. Tell students that the items listed on the chalkboard must be included in the information as well as other interesting facts.

4. Tell students that each group must prepare a "graffiti-style" poster displaying information about their chosen planet. Tell students to make a presentation to the class about the planet. Explain to

students that the presentation may be an imaginary tour of the planet, a quiz program involving group members, a rap, interviews with imaginary inhabitants of the planet, or a panel discussion. However, all group members must participate in the presentation.

Day 3

Have each group make a presentation about their planet to the class.

GRADE 8
EARTH SCIENCE

UNIT: Our Solar System
TOPIC: The Planets
OUTCOME: 51. State Kepler's three laws.

Background

This activity helps students understand Kepler's laws of planetary motion. Prior to this activity, discuss Kepler's Three Laws of Planetary Motion. Kepler's First Law states that each planet moves around the sun in a path called an ellipse. The Second Law states that an imaginary line drawn from the center of the sun to the center of a planet will trace out equal areas in equal periods of time. Kepler's Third Law of Planetary Motion states that a planet's period (time of one revolution around the sun) squared equals the planet's distance from the sun cubed.

NOTE: It is important that students understand the terms aphelion (the point on the earth's orbit farthest from the sun) and perihelion (the point on the earth's orbit nearest to the sun).

Students may work independently or in groups for this activity.

Materials

- Thumbtacks
- Cardboard sheets (8 1/2" x 11")
- String
- Metric rulers
- Compass
- Calculator
- Overhead projector
- Handout, PLANETARY MOTION
- Handout, TEACHER'S GUIDE SHEET

Procedures

1. Distribute the thumbtacks, cardboard, and a piece of string approximately 25 cm long to each student or group. Tell students that in the 17th century, a German mathematician and astronomer named Johannes Kepler found that the orbits of the planets are not perfect circles. Ask students to relate Kepler's First Law of Planetary Motion. (Each planet moves around the sun in a path called an ellipse.)

2. Give students instructions for constructing an ellipse:

   - Make a loop by tying the ends of the string together.

   - Push two thumbtacks into the cardboard about 10 cm apart.

   - Place the string around the thumbtacks as shown below. The string should contain slack.

- Place a pencil inside the string loop and pull outward against the loop until the string is tight. Keep the string tight while tracing with the pencil all the way around the thumbtacks. The figure drawn is an ellipse similar in shape to a planet's orbit around the sun.

3. Ask students to explain Kepler's Second Law of Planetary Motion. (An imaginary line drawn from the center of the sun to the center of a planet will sweep out equal areas in equal periods of time.)

4. Tell students they will be provided an opportunity to observe this law. Give each student a copy of the Handout, PLANETARY MOTION. Place a transparency of this handout on the overhead projector.

5. Ask a student volunteer to go to the screen on which the transparency is being projected and indicate which point represents the sun. Ask the student to trace the dots representing the planet's orbital path with a pointer. Have the student indicate the perihelion and the aphelion. Explain to students that a planet traveling along this orbital path takes the same length of time to travel from one dot to the next. Ask why the dots are farther apart at the perihelion than at the aphelion. (A planet travels faster when it is closer to the sun and more slowly when it is farther from the sun.)

6. Ask students to divide the drawing of the dots into three sections. To help students understand this process, remove the transparency from the overhead projector and use a ruler to draw a section. (See Teachers Guide Sheet containing this activity.) Project this image on the screen for the students. Explain that sections may be adjacent to one another or may be spread out. Explain to students that according to Kepler's Second Law, the area of each of these sections is equal. Using a simple formula, have students calculate these areas to determine if this statement is true. Give students instructions for calculating the areas of the sections:

   - Sections form triangles. Using the compass, construct a perpendicular from the dot opposite the longest side of each triangle to the longest side.
   - Carefully measure the length of the perpendicular and of the longest side. Be as accurate as possible in this measurement. (Suggest that students use centimeters as their unit of measure.)
   - Using the formula, A=1/2bh, where A=area, b=base (longest side), and h=height (length of perpendicular), find the area of each section.

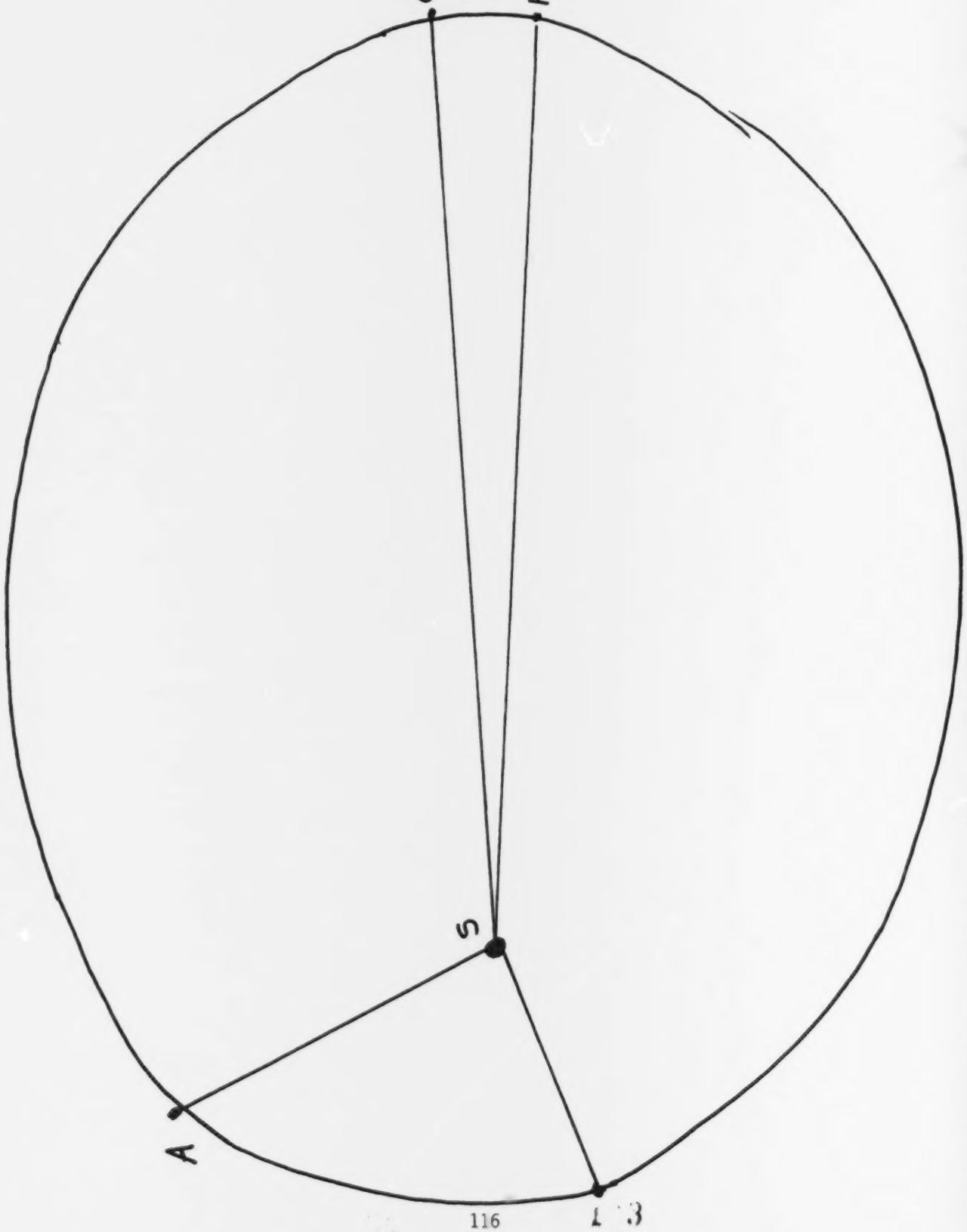
7. Ask students to share results. Point out to students that errors in measurement, inaccuracies in ruler markings, and other factors may make areas unequal. However, ask students to notice that areas are nearly the same. Explain to students that this is an example of Kepler's Second Law of Planetary Motion.

8. Explain to students Kepler's Third Law of Planetary Motion. A planet's period is the time it takes to make one revolution around the sun. The law states that the period squared (P^2) equals the planet's distance from the sun cubed (D^3). For example, Jupiter's period, in earth time, is 11.85 years. Jupiter's distance from the sun, astronomical unit (a.u.), is 5.20. Jupiter's period, squared, is 140.42. Jupiter's distance from the sun, cubed, is also 140.42.

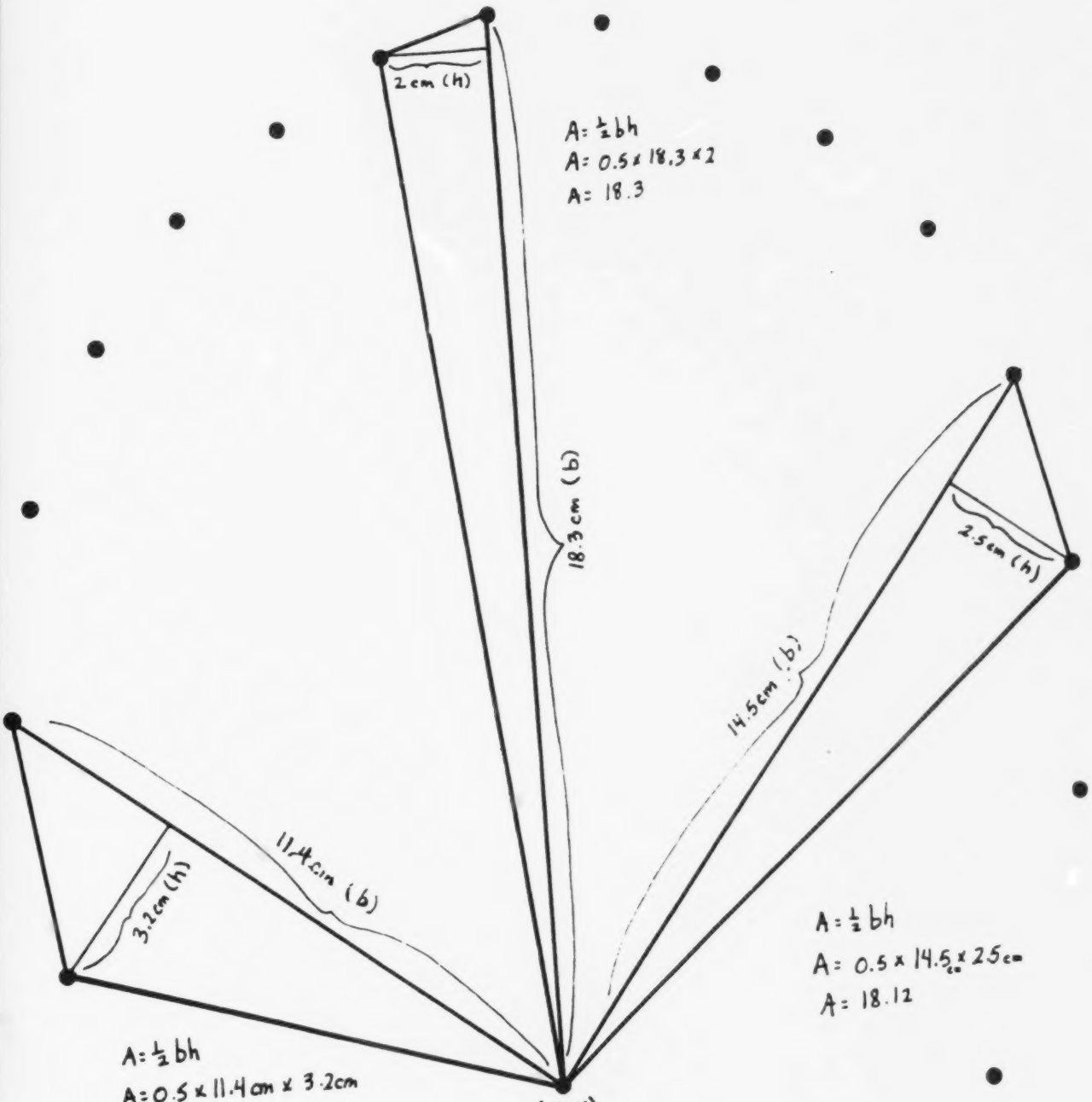
*Thank you to Dr. Susi H. Shepard, College of Education, University of South Alabama, for contributing her ideas and the handout for this activity.

PLANETARY MOTION
Handout

PLANETARY MOTION
Handout



TEACHER'S GUIDE SHEET
Handout



GRADE 8
EARTH SCIENCE

UNIT: Our Solar System
TOPIC: The Planets
OUTCOME: 52. Describe the protoplanet model.

Background

This activity presents one theory of how planets were formed. Prior to beginning the activity, discuss with students information about the protoplanet theory. Include the following information: At this time, most scientists believe the solar system began with the birth of the sun. According to this theory, about five billion years ago only a thin cloud of gas and dust occupied the part of the Milky Way where our solar system now exists. Hydrogen atoms made up most of this gas cloud. Most of the dust particles were made of the kinds of atoms which compose the rocks and minerals found on earth. Something, perhaps a nearby supernova explosion, sent a shock wave through the cloud and caused it to shrink. As the atoms and particles in the cloud crowded together, gravity began to take over. The mutual attraction between the atoms and dust particles drew them together into clumps. As more and more matter moved toward the center of the cloud, it began to rotate and grow hot. This is a theory of how our sun was formed.

It is theorized that a thin sheet of clumped matter was rotating around the equatorial plane of the young sun. Scientists further theorize that gravity slowly pulled some of these small clumps together to form larger bodies. As these clumps of matter continued to collide with one another, they grew into still larger bodies called protoplanets. Four of these protoplanets formed close to the young sun. These were the inner planets, Mercury, Venus, Earth, and Mars. The remaining protoplanets formed farther from the dense, hot, central disc and became the outer planets.

Following the activity prepare to give students additional information about how the planets' positions may have influenced their sizes and compositions and how the beginnings of nuclear fusion in the sun may have affected planet atmospheres.

Materials

- Plastic petri dishes
- Iron filings
- Magnets

Procedures

1. Discuss the development of protoplanets. Explain to students that to demonstrate how a force such as gravity can draw matter together, the activity uses a different force called magnetism.

2. Divide students into groups and give each group a petri dish, iron filings, and magnet. Have students sprinkle a thin layer of filings in the bottom half of the petri dish. (Students need not use the top of the petri dish.) Have students touch the magnet beneath the petri dish near the outside edge. Have students slowly circle the magnet beneath the petri dish, starting with the outside edges and slowly working toward the center. Ask students to observe what happens to the iron filings. (They clump together in an increasingly larger mass due to the force of magnetism.) Ask students what this has in common with the formation of protoplanets. (The protoplanets are theorized to have formed as gravity caused more and more matter to clump together.) Be certain students understand that gravity and magnetism are two different forces. Explain to students that magnetism is a simple way to demonstrate how gravity may have caused particles and atoms to clump together into protoplanets.

3. Ask students to suggest other ways to illustrate protoplanet formation.

GRADE 8
EARTH SCIENCE

UNIT: Our Solar System
TOPIC: The Moon
OUTCOME: 53. Describe the surface of the moon.
54. Describe forces that change the surface of the moon.

Background

Prior to this activity, discuss with students the surface features of the moon including:

- Marias--flat plains, or depressions, on the moon. Probably formed by lava flows.
- Explosion craters--hollows in the surface of the moon made by impact with bodies such as meteorites.
- Chain craters--small pits in the moon's surface, usually located within a maria. Probably formed during violent volcanic eruptions of gas.
- Rills--canyon-like grooves or cracks in the moon's surface. Probably formed during cooling in the early history of the moon. However, may be associated with lava flows.
- Rays--bright streaks on the surface which radiate outward like the spokes of a wheel. Probably made of fine, dustlike material.
- Mountains--possibly formed by volcanic activity.

Before beginning the activity, pour 3 inches of cement powder into each shoebox (or pan).

Materials

- Shoeboxes or deep pans
- Cement powder (about 6-8 cups)
- Tongue depressors or wood splints
- Small rocks of different sizes
- Dried peas and dried beans
- Marbles
- Washers
- Tweezers
- Picture of lunar surface

Procedures

1. Display the picture of the lunar surface. Tell students that fine dust or powder covers much of the moon's surface. Inform students that dry cement powder is similar to lunar soil in color and texture.

2. Divide students into groups. Equip each group with a shoebox containing cement powder, 2 tongue depressors, several small rocks, bean, pea, marble, washer, and pair of tweezers.

3. Give students the following instructions:

   - Use the tongue depressor or wood splint to gently smooth the surface of the lunar soil.

   - Drop a rock from a few inches above the lunar soil. Remove the rock with tweezers and observe any changes in the lunar soil. Describe and relate the changes to the moon.

   - Repeat the action using a different size pebble. Observe and describe changes made to the moon.

   - Smooth the lunar soil. Experiment by dropping a bean, pea, washer, and marble into the soil. Instruct students to notice the shape of the craters.

   - Use the tongue depressor to make a deep crack, or rill, in the lunar soil. Practice making a mountain range.

   - Observe the picture of the lunar surface. Make rays and marias in the lunar surface.

   - Make a lunar landscape. Include as many different kinds of lunar features as possible.

4. When groups have completed their landscapes, have each group take turns naming the different surface features.

GRADE 8
EARTH SCIENCE

UNIT: Earth
TOPIC: The Moon
OUTCOME: 55. Discuss four phases of the moon.

Background

This activity identifies four major phases of the moon: the new moon, first quarter moon, full moon, and last quarter moon. To help students understand how the moon progresses through each phase, the activity also employs the following concepts:

- As the moon changes from a new moon to a full moon, more and more of its lighted surface is visible. The moon is said to be waxing, or growing larger.

- As the moon changes from a full moon back to a new moon, less and less of the lighted surface is visible. The moon is described as waning or getting smaller.

- If the lighted portion of the moon is smaller than a quarter moon, the moon is called a crescent.

- If the lighted portion of the moon is larger than a quarter moon but less than a full moon, the moon is called gibbous.

Before beginning the activity, prepare copies of the Handout, MOON PHASES.

Materials

- Plastic foam balls
- Lamp without shade
- Sharpened pencils
- Handout, MOON PHASES
- Chalkboard

Procedures

1. Following a discussion of moon phases, explain to students that the activity can demonstrate the moon phases with a lamp and a plastic foam ball.

2. Divide students into groups and equip each group with a lamp, plastic foam ball for each student, and copies of the Handout, MOON PHASES.

3. Have students impale a pencil into each ball to use as a handle. Explain to students that the balls represent the moon, the lamp represents the sun, and the students represent observers on earth.

4. Have each group place the lamp in the center of a table. Position students within an arm's length around the lamp. Allow as much space between students as possible. Ask students to turn on the lamp. Darken the classroom.

5. Instruct students to hold the balls at arm's length between the lamp and their eyes.

   NOTE: Caution students not to stare directly at the light and to observe the plastic foam ball.

   Point out that this presentation represents position 1 on the Handout, MOON PHASES. Ask students if they can observe any of the lighted part of the moon and what phase of the moon this presentation represents. (New moon)

6. Ask students to move the moon slowly around themselves (earth) by turning to the left until the side facing them is entirely lighted. Be certain that students turn as their moons revolve so that they are always facing their moon. Ask students to observe that as the moon revolves into position, more and more of the lighted side becomes visible. Explain to students that the moon is said to be waxing when appearing to grow larger. When students have revolved their moons into position, ask what phase of the moon is represented. (Full moon) Direct students' attention to the handout and ask what position this representation demonstrates. (Position 5)

7. Have students continue turning slowly to their left while rotating their moons back into the new moon position. Ask students what happens to the visible lighted part of the moon as they complete this action. (The visible part becomes smaller and smaller.) Explain to students that the moon is said to be waning when it becomes smaller.

8. Direct students' attention to the handout and ask students to revolve their moons into position 3. Ask students how much of the lighted portion of the moon can be seen. (One-half) Ask what this phase is called. (First quarter moon) Repeat this procedure for position 7. Ask what this phase is called. (Last quarter moon)

9. Have students hold their moons in position 2, then in position 8, and observe the lighted areas. Ask students how much of the moon is visible. (Less than half of the lighted side)

   - Ask what this phase is called? (Crescent moon)

   - Ask which position is a waxing crescent. (Position 2)

   - Ask which position is a waning crescent. (Position 8)

10. Have students hold their moons in position 4, then in position 6, and observe the lighted areas.

   - Ask how much of the moon is visible. (More than half of the lighted side, but less than a full moon)

   - Ask what this phase is called. (Gibbous moon)

- Ask which position is a waxing gibbous. (Position 4)

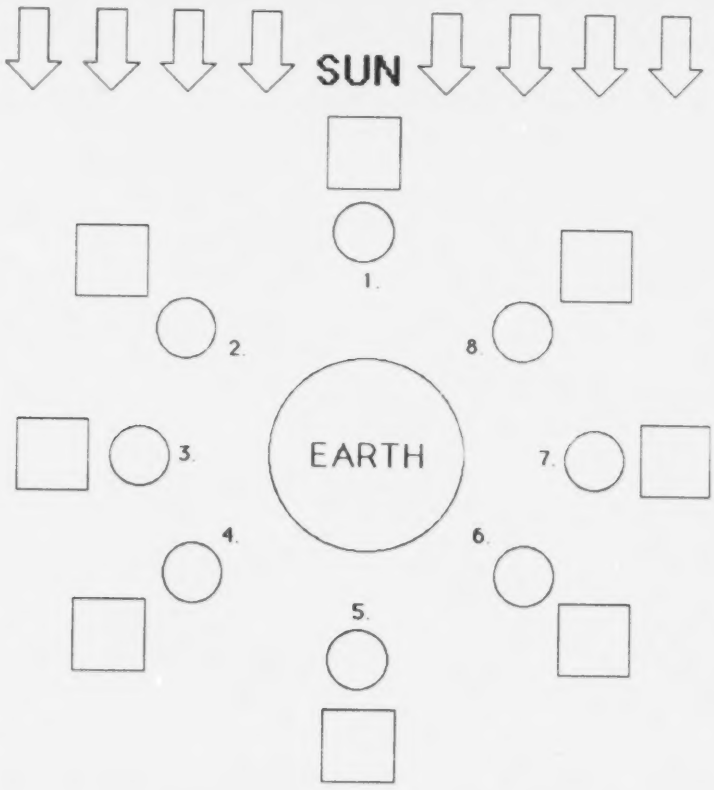
- Ask which position is a waning gibbous. (Position 6)

11. Have students follow the instructions on their handouts. When students complete the handouts, conclude the activity by having a volunteer diagram the moon's phases on the chalkboard. Have other volunteers answer questions.

MOON PHASES
Handout

The moon seems to change shape during the month as it goes through phases. In this activity, you learn how these phases occur.

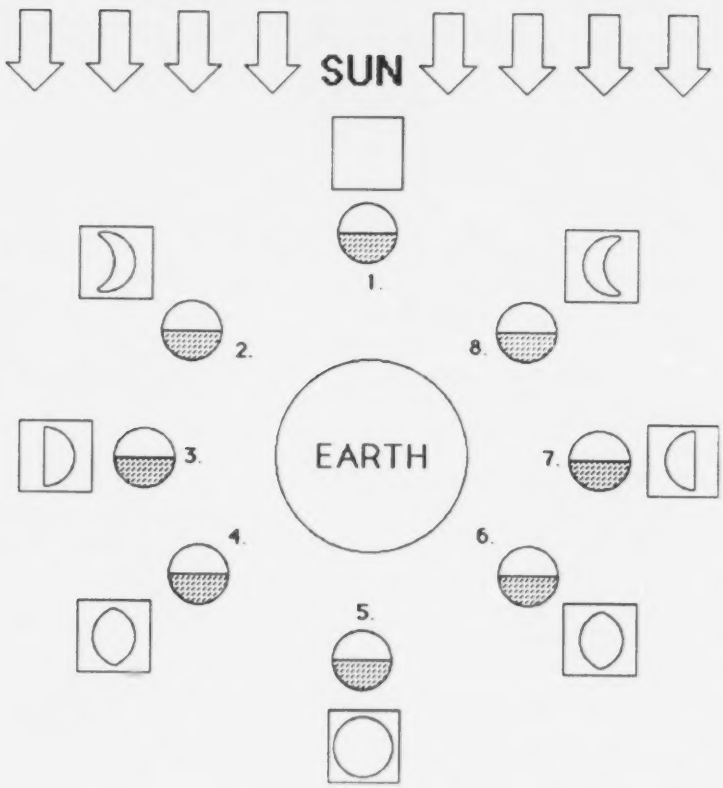
Directions: The plastic foam ball represents the moon, the lamp represents the sun, and you are an observer on earth. Hold the ball at arm's length between your eyes and the lamp. This is position 1 on the diagram. Is any of the lighted part of the moon visible? Shade the circle in position 1 to show how much of the moon is lighted, including the part you cannot see from earth. In the box near position 1, draw a diagram to show how much light is visible to you (if any). In the appropriate space beneath the diagram, write the name of the phase represented. Repeat this procedure for positions 2 through 8.



Position:	Name of phase	Position:	Name of phase
1	_____	5	_____
2	_____	6	_____
3	_____	7	_____
4	_____	8	_____

Based on your observations, what causes the moon's phases?

MOON PHASES
Key



Position:	Name of phase	Position:	Name of phase
1	New Moon	5	Full Moon
2	Waxing Crescent	6	Waning Gibbous
3	First Quarter	7	Last Quarter
4	Waxing Gibbous	8	Waning Crescent

Based on your observations, what causes the moon's phases? (One side of the moon is always lighted by the sun. As the moon revolves around the earth, different amounts of this lighted side are visible from earth. This phenomenon causes the moon to appear to change shape. These apparent changes in shape are called phases.)

GRADE 8
EARTH SCIENCE

UNIT: Our Solar System
TOPIC: The Moon
OUTCOME: 56. Relate position of the moon, sun, and earth to tides.

Background

This activity helps students understand how the gravitational pull of the moon and sun affects the earth's waters. Prior to this activity, students should be familiar with various phases of the moon presented in Outcome 55.

Materials

- Scissors
- Handout, TIDES
- Chalkboard

Procedures

1. Ask students to describe a day at the beach. Ask students if the water stays at one level all the time and what the rising and falling of the ocean water is called.

   Explain to students that the rise and fall of ocean waters at regular intervals is called tides. Tides are caused by the gravitational attraction between the earth, moon, and sun. Explain to students that tides are actually bulges of water which are always present on the earth.

2. Give each student scissors and a Handout, TIDES. Ask students to cut out the sun, earth, moon, and the three oval shapes which represent tides.

3. Tell students that the oval shapes represent the bulges of water we call tides. Have students place the circle representing Earth in the center of oval number 1 and place the moon so that it is opposite one end of the oval. Draw the following diagram on the board if needed.

Direct students to turn the earth so that the number 1 is facing the moon. Ask students the following questions:

a. Which sides of the earth are having high tide? (1 and 3)

b. Which sides of earth are having low tide? (2 and 4)

Call attention to the fact that high tides occur on opposite sides of the earth at the same time and that the same is true of low tides.

4. Ask students how long it takes the earth to rotate. Tell students to turn their earth a quarter turn, following the directions of the arrows, so that the number 2 is facing the moon. Ask students the following questions:

   a. Approximately how much time is required for the earth to rotate that distance? (About 6 hours).

   b. Which sides of the earth are having high tides now? (2 and 4.)

   c. What is happening to sides 1 and 3? (They are having low tides.)

5. Ask students to rotate the earth another quarter turn so that the number 3 is facing the moon. Ask students the following questions:

   a. What kind of tide is side 1 having now? (High tide)

   b. About how much time has passed since the last time side 1 had a high tide? (About 12 hours)

   Explain to students that due to the moon's gravity, a bulge of ocean water always faces the moon. As the earth rotates, different parts of the earth face the moon. This phenomenon causes the tides to keep changing.

6. Ask students what other heavenly body exerts gravitational pull on the earth. (The sun) Ask students which body, the sun or the moon, has a greater effect on tides. (The moon does because it is so much nearer to Earth than the sun.) Explain to students that when the sun's gravity is combined with that of the moon, two special kinds of tides occur.

7. Ask students to remove oval number 1 from beneath their earth and to replace it with oval number 2. Call attention to the fact that the high tides in this demonstration are higher than usual. Explain to students that this observable event is because the sun's gravity is now a factor. Ask students to decide how they think the earth, sun, and moon might be positioned to cause the tides to be higher than normal. Draw the following figure on the chalkboard.

Fig. A

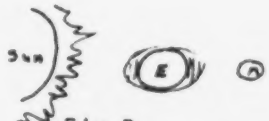


Fig.B

Explain to students that these higher-than-normal tides are called spring tides and occur twice a month when the earth, sun, and moon are aligned in a straight line. Point to Fig. A. Ask students what phase of the moon occurs when the earth, moon, and sun are aligned in this position. (New moon) Point to Fig. B. Ask students what phase of the moon occurs when the sun, moon, and earth are aligned in this position. (Full moon). Ask students when spring tides occur. (During full moons and new moons)

8. Have students replace oval number 2 with oval number 3. Point out to students that the tides in this demonstration are lower than usual. Ask students to decide how they think the earth, sun, and moon might be positioned to cause the tides to be lower than normal. Draw the following diagram on the chalkboard.

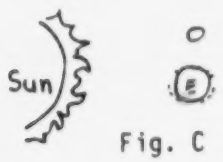


Fig. C

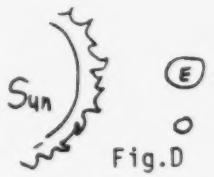


Fig.D

Explain to students that these tides are called neap tides. The tides occur twice a month when the earth, sun, and moon are at right angles to each other. Point to Fig. C. Ask what phase of the moon occurs when the earth, moon, and sun are aligned in this position. (Last quarter moon) Point to Fig. D. Ask what phase of the moon occurs when the sun, moon, and earth are aligned in this position. (First quarter moon). When do neap tides occur? (During quarter moons)

9. Have students pretend to go to the beach at Gulf Shores, Alabama, to study the tides and to observe a high tide that occurs at 12:00 midnight. Ask students the following questions:

   a. When will the next low tide occur? (About 6:00 am)

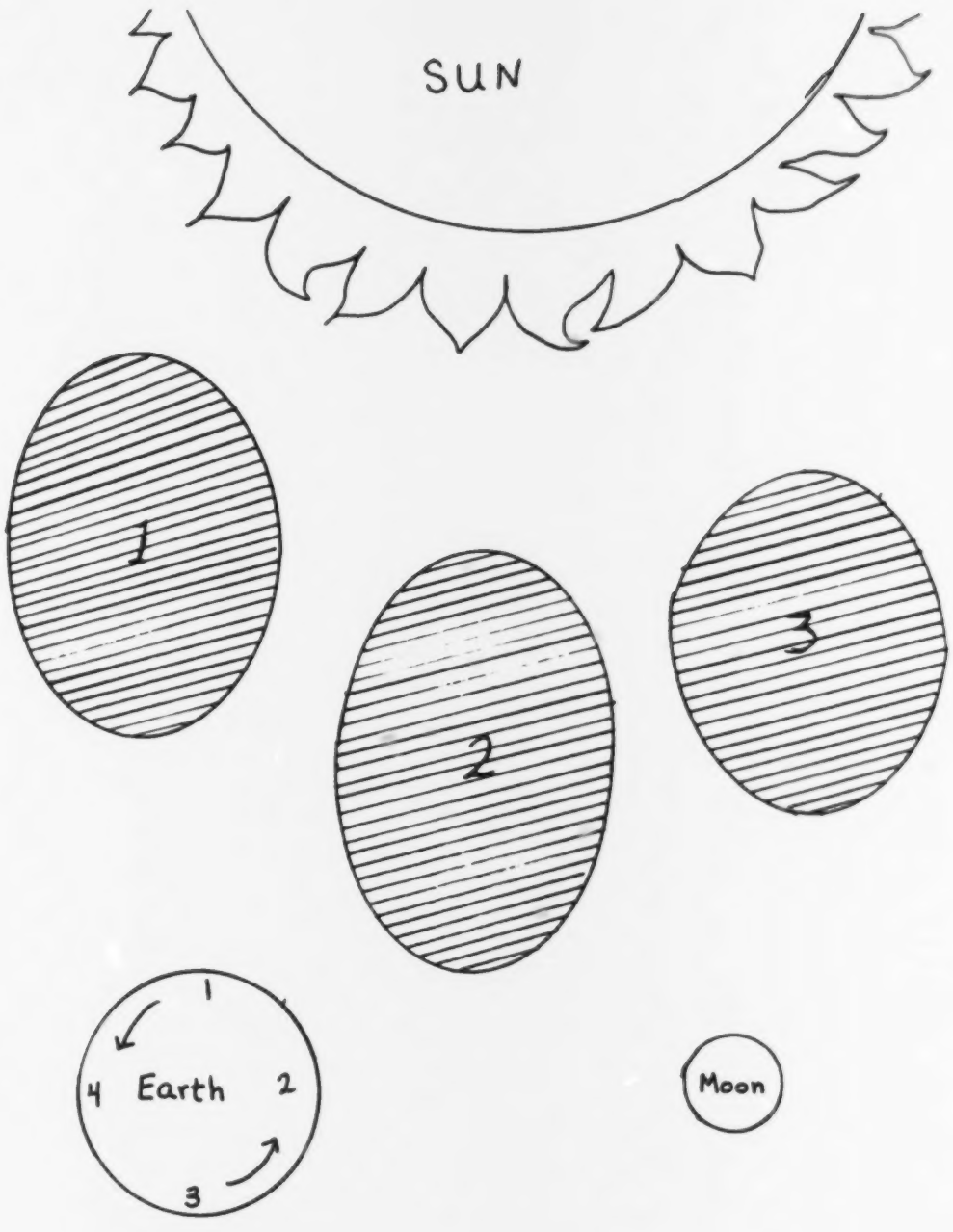
   b. When will the next high tide occur? (About 12:00 noon)

   c. When will the second low tide occur? (About 6:00 pm)

   NOTE: Explain that high tides do not occur exactly 12 hours apart but approximately 12 hours and 25 minutes apart.

10. Have students practice positioning their earth, moon, and oval number 1 figures to show low tides and high tides. Ask students to explain how often high tides and low tides occur. Have students practice positioning their earth, moon, sun, and ovals 2 and 3 to show spring tides and neap tides. Ask students how often spring and neap tides occur and how they are related to moon phases.

TIDES
Handout



GRADE 8
EARTH SCIENCE

UNIT: Our Solar System
TOPIC: The Moon
OUTCOME: 57. Describe the processes of eclipses.

Background

Before beginning this activity, ask students to study the relative positions of the sun, earth, and moon during both solar and lunar eclipses. Review the following concepts with students:

- The moon revolves, or moves, around the earth in an orbit.

- The moon is approximately one-fourth the size of the earth.

- The earth tilts on its axis about 23.5 degrees.

Materials

- Flashlights
- Light-colored modeling clay or plastic foam balls
- Tongue depressors
- Unlined paper
- Chalkboard

Procedures

1. Divide students into groups and equip each group with a flashlight, 2 1/2 sticks of modeling clay, 2 tongue depressors, and several sheets of unlined paper.

2. Direct each group to use 2 sticks of modeling clay to make a model of the earth and one-half stick of modeling clay to make a model of the moon. Instruct students to insert a tongue depressor in each model to serve as a handle.

3. Explain to students that the flashlight represents the sun. Have one student in each group turn the flashlight on and hold it horizontally about 12 inches above the desk or table on which the group is working.

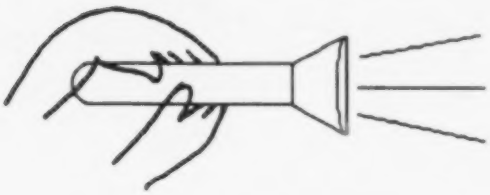
   CAUTION: Instruct students not to look directly into the light. Explain to students that looking at the sun even when using sun shades can cause permanent eye damage.

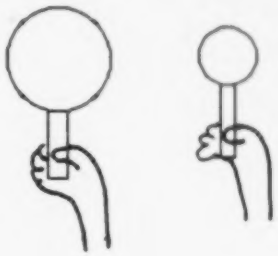
4. Draw a line on the chalkboard which approximates the 23.5 degrees of tilt of the earth on its axis. Have a student in each group position the model of earth 12 inches from the sun with the same degree of tilt.

5. Turn out the lights in the classroom and make the room as dark as possible.

6. Direct students who are holding the models of earth to adjust the position of the models so that they receive full light from the sun.

7. Have one student from each group position the moon model approximately 2 inches from the earth and revolve the moon around the earth slowly until the earth is directly between the moon and the sun.

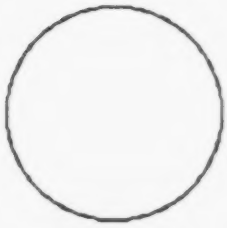




8. Have students position the moon so that the earth's shadow totally blocks sunlight from the moon's surface. Ask students what the moon would look like at this time if it were viewed from the earth. Tell students that this example demonstrates a total lunar eclipse.

9. Have students position the moon so that only part of its surface reflects the sun's light. Tell students that this example demonstrates a partial lunar eclipse.

10. Have students revolve the moon into the total lunar eclipse position again and notice how the shadow of the earth appears to move across the moon during the eclipse. Explain to students that the moon becomes darker as it moves into the earth's shadow.



Sun

earth moon

Lunar Eclipse

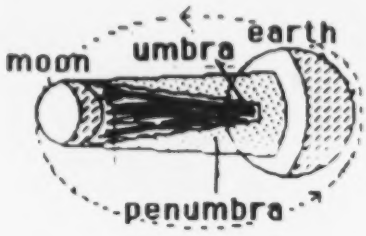
11. Instruct students to move the moon slowly until its orbit places it between the sun and the earth and blocks off light from some areas of the earth. Explain to students that this is a demonstration of a solar eclipse, however, only a portion of the earth experiences the eclipse.

12. Ask students to observe the shadow on the earth's surface and note that the center portion of the shadow is darker than other parts of the shadow. Explain to students that this area is called the umbra and is the area of total solar eclipse while the lighter area of the shadow is called the penumbra and is the area of partial solar eclipse.

13. Allow students to repeat the procedure several times by taking turns positioning the sun, moon, and earth.

14. Turn on the lights in the classroom and conclude the activity by directing students to draw both lunar and solar eclipses on the unlined paper.

Sun



Solar Eclipse

GRADE 8
EARTH SCIENCE

UNIT: Space Investigations
TOPIC: Unmanned
OUTCOME: 58. Explain use of satellite feedback.
59. Interpret and predict use of space observatories.

Background

In 1957 Russia astounded the world by sending into orbit the first space satellite. It was simply a metal ball, Sputnik, that beamed radio waves back to earth, but, in another sense, it changed the world and rocketed mankind into the Space Age.

Since 1957 several hundred satellites and space observatories have been launched into space. These orbiting objects have transmitted information to earth on such subjects as magnetic fields, radiation, magnetism, earth size and shape, weather conditions, earth terrain, solar flares, ultraviolet rays, navigation patterns, communications, plant and animal life, and military installations.

Everyday each of us is privileged to receive information directly from weather satellites and communication satellites. Television sets receive information such as a view of a hurricane as it forms in the Gulf of Mexico or a golf game as it is being played in England.

Materials

None

Procedures

1. Instruct students to watch a national news program and a local news program or weather channel for content. Have students list items of information coming from communications or weather satellites.

2. Have students scan a newspaper for photographs that are transmitted by satellites.

3. Have students report their observations and display pictures to the students in the classroom.

GRADE 8
EARTH SCIENCE

UNIT: Space Investigations
TOPIC: Unmanned and Manned
OUTCOMES: 60. Name some unmanned space missions.
63. Discuss accomplishments in space.
64. Name some of the astronauts.

Background

This activity is designed to capture students' interest in retaining knowledge of unmanned space missions, astronauts, and accomplishments in space. By having students create a board game, they will be more interested in researching the topics listed to find detailed and unique facts about each topic. Before beginning the activity, divide the class into groups. The activity requires 4 days.

Materials

- Posterboard
- Cardboard
- Brads
- Markers
- Crayons
- Colored pencils
- Index cards
- Pencil
- Paper

Procedures

Class Period 1

1. After introducing a space exploration unit, divide students into groups. Take the groups of students to the library to research unmanned and manned space missions and major accomplishments that have resulted from space sciences. Instruct students to assign topics to individual group members. Tell the students in the groups to formulate questions in order to locate facts about space missions and people involved in space sciences.

2. Direct each group of students to write a minimum of 25 questions based upon their research. Instruct students to write only one question on each card or piece of paper.

Class Periods 2 and 3

1. Instruct students of the groups to design a board game with the following components contained in each game:

   A. Game board, indicating beginning and ending points and including various pitfalls or problems which might be encountered during the game.

B. Object of the game, i.e., first player to reach alpha centauri, player who owns the most space resources, or the first player to escape the solar system.

C. Means of moving along the board, i.e., dice, spinner, or questions.

D. Game pieces to represent the players, i.e., spaceships, astronauts, probes.

E. Written set of rules which explain the objective of the game and the order of play.

Class Period 4

1. Direct the groups of students to exchange games, play the games, and select by popular vote the game which is the most creative and fun.

2. After deciding on the best designed game, hold a class tournament to select the leading authority on unmanned, astronaut, and space science accomplishments.

Variations

1. Exchange games between students in different class periods.

2. Allow students who create outstanding games to share the games with other science classes.

3. Design individual games on individual topics.

GRADE 8
EARTH SCIENCE

UNIT: Space Investigations
TOPIC: Manned
OUTCOME: 61. Survey the scope of manned expeditions.
62. Compare and contrast manned expeditions versus unmanned expeditions.

Background

The vast majority of Russian and American space efforts have been involved in achieving earth orbit, whether the payload was a manned or unmanned capsule. Relatively few expeditions into space have been designed to go beyond earth orbit, including both manned and unmanned types.

This activity is designed to assist students to contemplate "beyond earth orbit" expeditions. Manned vehicles are generally referred to as spacecraft. Unmanned, extra-orbital vehicles are called space probes.

The activity identifies spacecraft and space probes that have exited earth orbit. Extra-orbital manned flights have been limited to achieving moon orbit and moon landings. (See Handout, MANNED EXTRA-ORBITAL FLIGHTS.) A large number of space probe efforts have been attempted. (See Handout, U. S. SPACE PROBES.)

Materials

- Handout, MANNED EXTRA-ORBITAL FLIGHTS
- Handout, U. S. SPACE PROBES

Procedure

1. Assign students to groups. Give each group of students copies of both handouts.

2. Tell students to initially read and discuss both handouts.

3. Have each group of students make a decision to recommend either future manned flights or space probes, giving justifications for their decision. Remind groups that decisions must be based upon such considerations as scientific value, time constraints, equipment requirements, and cost factors.

4. Have each group make a presentation and give reasons for their decisions.

MANNED EXTRA-ORBITAL FLIGHTS
Handout

Date of Flight	Name of spacecraft	Name(s) of Astronaut(s)	Duration of Flight	Remarks
May 18-26, 1969	Apollo 10 (U. S.)	Thomas P. Stafford Eugene A. Cernan John W. Young	192 hrs.	Descent in lunar module to within 14.5 kilometers of moon
July 16-24, 1969	Apollo 11 (U. S.)	Neil A. Armstrong Edwin E. Aldrin, Jr. Michael Collins	195 hrs.	First manned landing on the moon; Mare Tranquillitatis; lunar EVA time totalled 2 hrs. 13 min.
Nov. 14-24, 1969	Apollo 12 (U. S.)	Charles Conrad, Jr. Richard F. Gordon, Jr. Alan L. Bean	244.6 hrs.	Second manned lunar landing. Oceanus Procellarum; two lunar EVA's totaling 7 hrs. 39 min.
Apr. 11-17, 1970	Apollo 13 (U. S.)	James A. Lovell, Jr. Fred W. Haise, Jr. John L. Swigert, Jr.	142.9 hrs.	Planned lunar landing aborted after rupture of oxygen tank in service module
Jan. 31-Feb. 9, 1971	Apollo 14 (U. S.)	Alan B. Shepard, Jr. Stuart A. Roosa Edgar D. Mitchell	216.7 hrs.	Third manned lunar landing; Fra Mauro highlands; two lunar EVA's totaling 9 hrs. 19 min.
July 26-Aug. 7, 1971	Apollo 15 (U. S.)	David R. Scott James B. Irwin Alfred M. Worden	295.2 hrs.	Fourth manned lunar landing. Hadley Rill; three lunar EVA's for 18 hrs. 37 min.; use of lunar roving vehicle
Apr. 16-27, 1972	Apollo 16 (U. S.)	John W. Young Charles M. Duke, Jr. Thomas K. Mattingly	319.8 hrs.	Fifth manned lunar landing; Descartes crater; three lunar EVA's for 20 hrs. 14 min.
Dec. 7-19, 1972	Apollo 17 (U. S.)	Eugene Cernan Harrison Schmitt Ronald E. Evans	301.8 hrs.	Sixth and last U.S. manned lunar landing; Taurus-Littrow Valley.

U. S. SPACE PROBES
Handout

	NAME	DATE	REMARKS
LUNA PROGRAM			
	Luna 3	October 1959	- First probe to circle moon
	Luna 9	January 1966	- Made soft landing on the moon
	Luna 16	1970	- Gathered moon rocks and sent them to earth
	Luna 17	1970	- Landed moon vehicle driven by remote control
MARINER PROGRAM			
	Mariner 2	August 1972	- Launched toward Venus - Reported no magnetic field on the planet - Measured surface temperature
	Mariner 5	October 1967	- Another Venus probe - Made numerous photographs at close range
	Mariner 9	1971	- Arrived in vicinity of Mars - Made valuable photographs of Martian terrain
	Mariner 10	1967	- First close-up photographs of planet Mercury
VIKING		1976	- Made soft landing on Mars - Tested soil for signs of life
PIONEER		1972	- Launched toward Jupiter - Outstanding photographs of giant planet - Revealed new information about Jupiter's moons and giant red spot
VOYAGER		1977	- Reached vicinity of Saturn - Photographed rings and moons at close range

GRADE 8
EARTH SCIENCE

UNIT: Space Investigations
TOPIC: Manned
OUTCOME: 65. Discuss difficulties experienced in space.

Background

Atrophy of muscles is a problem caused from extended stays in space. Withering of muscle tissue results from lack of muscle use in a "free-fall" environment. (Space travel is not weightlessness but free-fall.) In this activity students are asked to design exercise machines to help maintain muscle tone. Students are asked to create, build, and demonstrate the principles involved in their own models. An example of a model will be described to give the teacher and students a better understanding of the objective. This activity is designed to be a student demonstration involving three or four students.

Materials

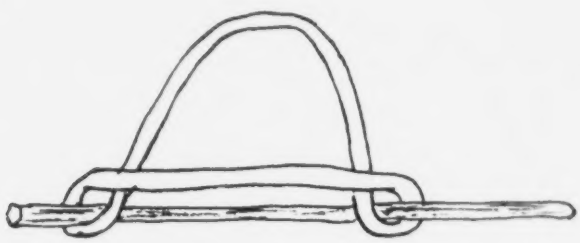
- Bicycle tire tube
- Broom handle or 1" x 2" board, 3' long
- Wide belt with hooks attached to each side (a harness)

Procedures

1. Give students the following set of directions.

   A. Place the wide belt with hooks around the waist of a student and attach the hooks to each side of a doorway or to two points on the wall. This "anchor" belt exemplifies the fact that anyone in the free-fall environment has great difficulty remaining stationary.

   B. Loop the bike tire tube around the broom handle as illustrated.



   C. Place one foot in the open end of the loop. Push down. Pull up on the broom handle with the arms. Hold this position for 15-20 seconds. Release and repeat 5 more times. Change legs and repeat the exercise.

2. Lead students in a discussion giving reasons why this exercise machine is appropriate for a space environment.

3. Instruct students to design their own space exercise machine or modify an existing earth exercise machine which might become useful as a space exercise machine. Remind students that weights in a free-fall environment are useless to anchor a person or for exercise.

4. Allow students several days to complete their inventions. Schedule an "exercise day" where students can demonstrate their machines.

Variations

1. Allow students to work in groups.

2. Invite a local sports fitness expert to share with the students the importance of well-toned muscles.

3. Direct all students to count resting pulse rate before using each machine and then after using each machine. Have students determine which machine offers the most exercise.

GRADE 8
EARTH SCIENCE

UNIT: Earth
TOPIC: Lithosphere
OUTCOME: 66. Define lithosphere, minerals.

Background

This activity follows instruction on the three major components of the earth: the atmosphere, lithosphere, and hydrosphere.

The lithosphere is the outermost portion of the earth's crust both above and below sea level. The earth's crust is thin under the ocean floor, thicker under the continents, and thickest on the mountains. Beneath the crust lies the mantle, a rocky layer which supports the crust. The mantle is the main component of the earth.

Materials

- Handout, OUTLINE OF SEVERAL CONTINENTS
- Plastic plates
- Scissors
- Clay (brown, tan, black, and green)
- Water
- Large clear beaker or container
- Paper

Procedures

1. Before beginning the activity, trace, cut out, and color the outlines of the continents on plastic plates.

2. Explain to students that this activity is a teacher-led demonstration and that students will be asked to assist. Inform students that they are to watch the demonstration and draw a picture to illustrate the demonstration.

3. Place small mounds of clay on the map representation of the east and west coasts of the North American continent to delineate the Appalachian and Rocky Mountains.

4. Have students observe the large, clear container. Select a student to place brown clay on the bottom of the container. Direct the students to form flat-topped mountains on the clay. Inform students that this model represents seamounts on the ocean floor.

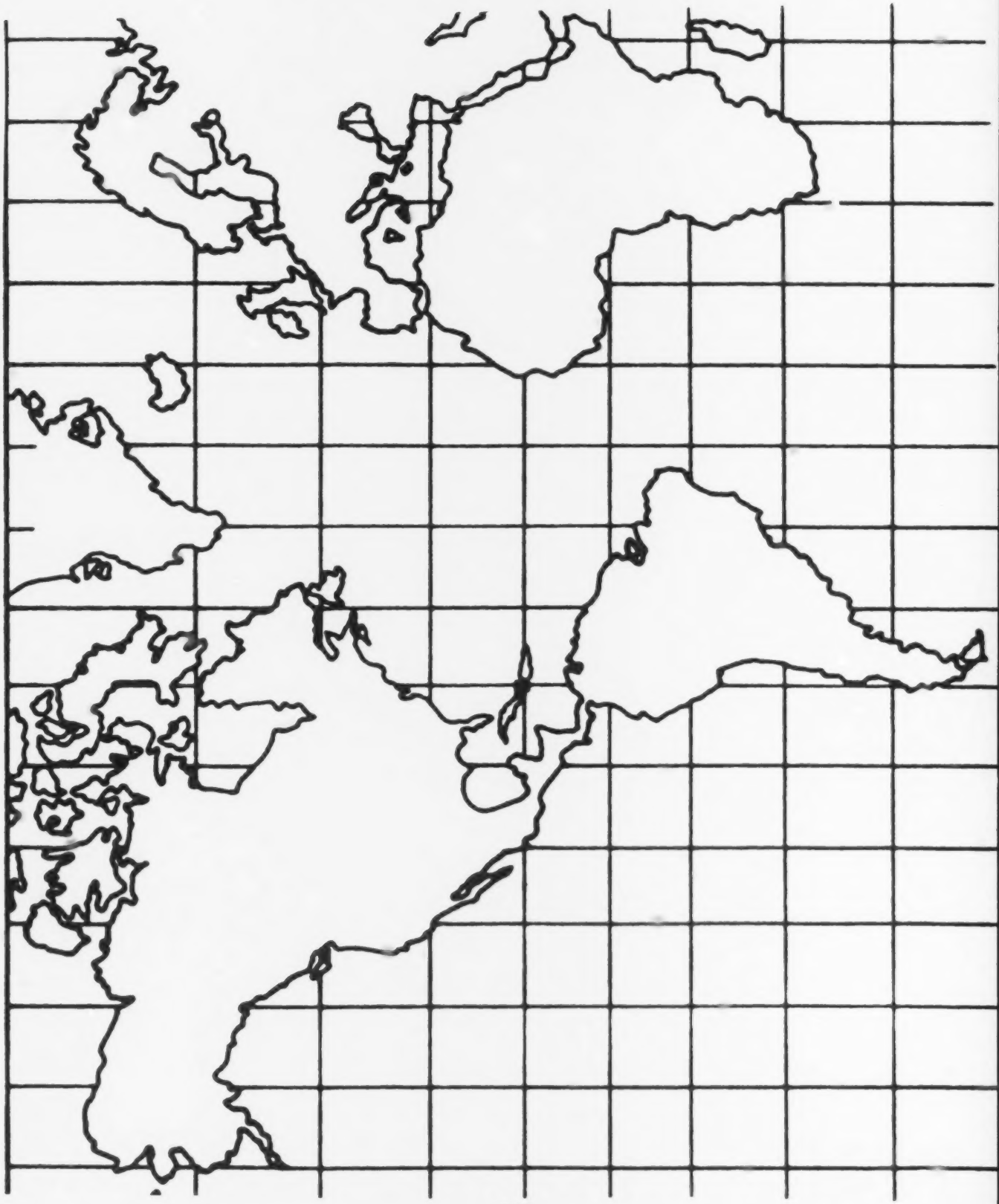
5. While students are drawing this portion of the activity, select another student to pour water into the container. Inform students that this represents the oceans or the hydrosphere.

6. Select a third student to lay or float the plastic continents on the water. Inform students that this model represents the manner in which the continents "float". Most of the mass of the continents is below sea level and is unseen.

7. Direct students to complete their drawings and label the continents, hydrosphere, and clay seamounts.

8. Leave the container in place and give all students an opportunity to examine it closely.

OUTLINE OF SEVERAL CONTINENTS
Handout



GRADE 8
EARTH SCIENCE

UNIT: Earth
TOPIC: Lithosphere
OUTCOMES: 67. Describe processes that form rocks.
68. Identify major kinds of igneous, sedimentary, and metamorphic rocks.
70. Explain uses of the three major kinds of rocks.

Background

Igneous rocks are formed from magma, a hot molten material found beneath the crust of the earth. Magma is under great pressure. If magma forces its way up near the surface of the earth, it becomes lava and forms igneous rocks that are glassy or fine-grained. If magma does not reach the surface of the earth, it cools slowly and forms coarse-grained igneous rocks. Granite is an igneous rock used for building and for monuments.

Sedimentary rocks form as a result of loose sediment which becomes hardened when it is cemented by underground mineralized water. Weight from upper layers of sediment and rock press down on the material, compressing it into rock. Sandstone is a sedimentary rock used for building purposes.

Metamorphic rocks are formed by high temperature and pressure on already existing igneous, metamorphic, and sedimentary rocks. The change occurs several miles below the surface of the earth. Marble is a metamorphic rock prized as a decorative building material.

Materials

- Library reference materials on rocks
- Rocks or pebbles
- Samples of three kinds of rock
- Chalkboard

Procedures

1. Draw Figure 1, FORMATION OF IGNEOUS ROCK, on the chalkboard and explain to students how igneous rock is formed by magma. Have students copy the drawing during the explanation.

2. Review formation of igneous, sedimentary, and metamorphic rock with students.

3. Bring to the classroom and display samples of igneous rock (pumice, granite, basalt), sedimentary rock (sandstone, limestone, coal), and metamorphic rock (quartzite, gneiss, marble, slate).

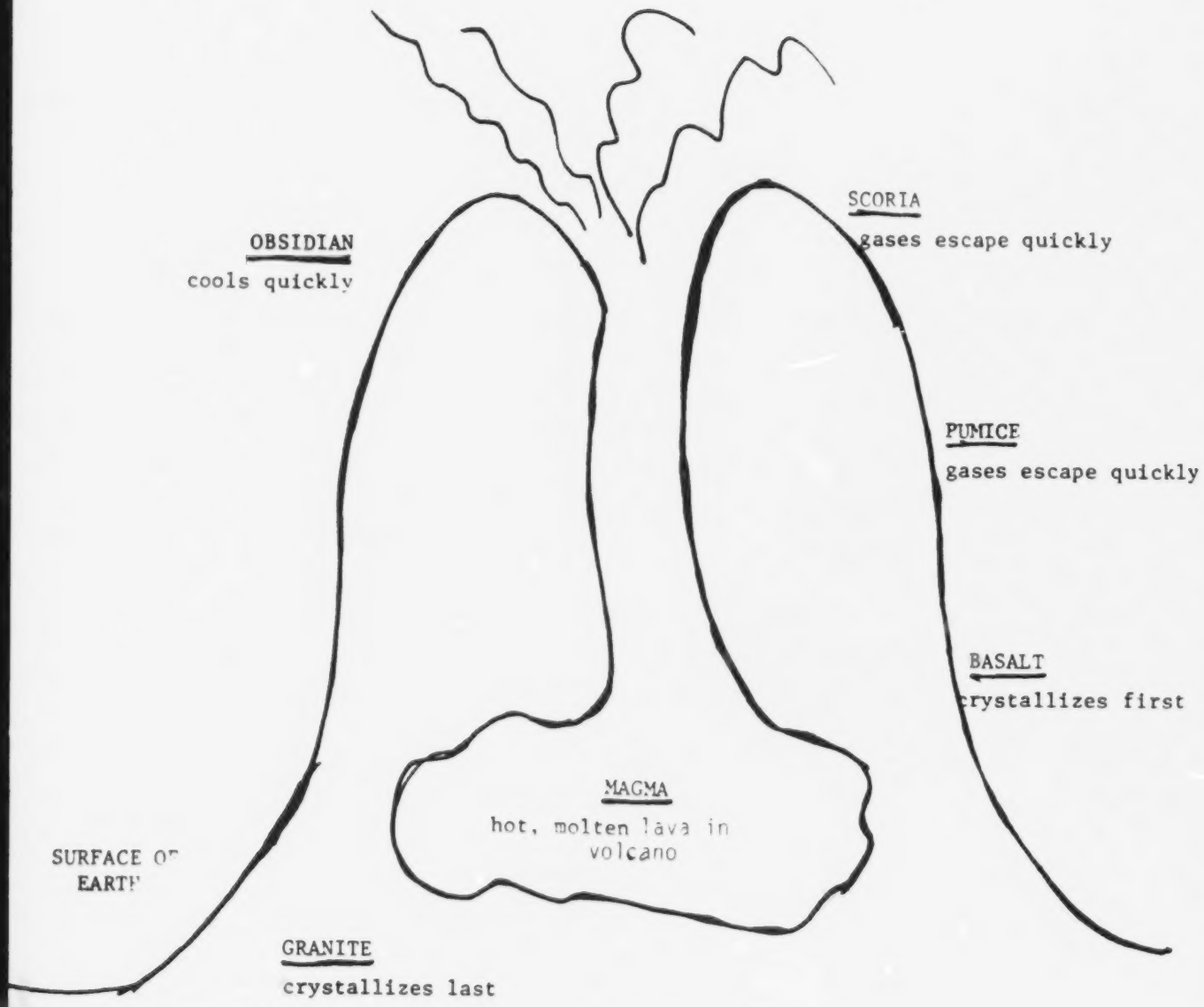
4. Have students read material in textbooks or library reference materials on the three major kinds of rock.

5. Allow students to examine and identify the rock samples.

6. Discuss students' classifications of rock samples and possible uses for each type of rock.

7. During the following few days, have students bring pictures or samples of rocks to share with students in the classroom. Allow students to explain where the samples were found and place pictures on a bulletin board entitled "ROCKS ARE USED EVERYWHERE."

Figure 1
FORMATION OF IGNEOUS ROCK



GRADE 8
EARTH SCIENCE

UNIT: Earth
TOPIC: Lithosphere
OUTCOME: 69. Explain the rock cycle.

Background

All rocks are made up of one or more minerals. Rocks are grouped by formation characteristics. The appearance of a rock is due to varying amounts and varieties of minerals. The three major groups of rocks are igneous, sedimentary, and metamorphic. Cooling lava or magma forms igneous rocks and deposited sediment forms sedimentary rocks. Sedimentary or igneous rocks, in turn, form metamorphic rocks. Processes that change or destroy rocks also create new rocks. Each kind of rock is the end of one process and the beginning of another process. Therefore, the "rock cycle" is a never-ending process.

Basalt, an igneous rock, probably was the original rock of the earth's crust. The crust weathered and washed into the ocean. The fragments that broke off hardened and formed sedimentary rocks. These rocks were buried deep in the crust where heat and pressure changed them into metamorphic rocks. Some of the metamorphic rocks were buried so deeply that they melted as a result of high heat. This melted material formed new igneous rocks. This activity follows the study of the three groups of rocks.

Materials

- Rock samples of granite, gneiss, limestone, marble, sandstone, quartzite
- Larger hand specimen of granite, gneiss, limestone, marble, sandstone, quartzite
- Handout, THE ROCK CYCLE
- Chalkboard

Procedures

1. Write the names of the six rock samples on the chalkboard.

2. Show students the samples of granite, limestone, and sandstone. Ask what processes changed these rocks and into which rock they were formed. (Granite into gneiss by melting and pressure. Limestone into marble by melting and pressure. Sandstone into quartzite by pressure and melting.)

3. Explain to students that changes in a rock's form do not have to take place in any special order. Any rock material can change into any kind of rock as various processes occur. The change of one kind of rock into another kind of rock is very slow and complex. The never-ending processes that rocks undergo is called the Rock Cycle.

4. Distribute to students the Handout, THE ROCK CYCLE. Write the following terms on the chalkboard: melting, weathering, pressure, chemical actions, magma, lava, and cementing.

5. Divide students into groups and give each group a set of rock samples. Instruct students to observe the black and white speckled rock (granite) and identify the rock into which it changed. (gneiss) Display the large specimen of limestone. Explain to students that through high pressure and temperature, the limestone was transformed into marble.

6. Display the large specimen of sandstone. Explain to students that through high temperature and pressure the sandstone was transformed into quartzite.

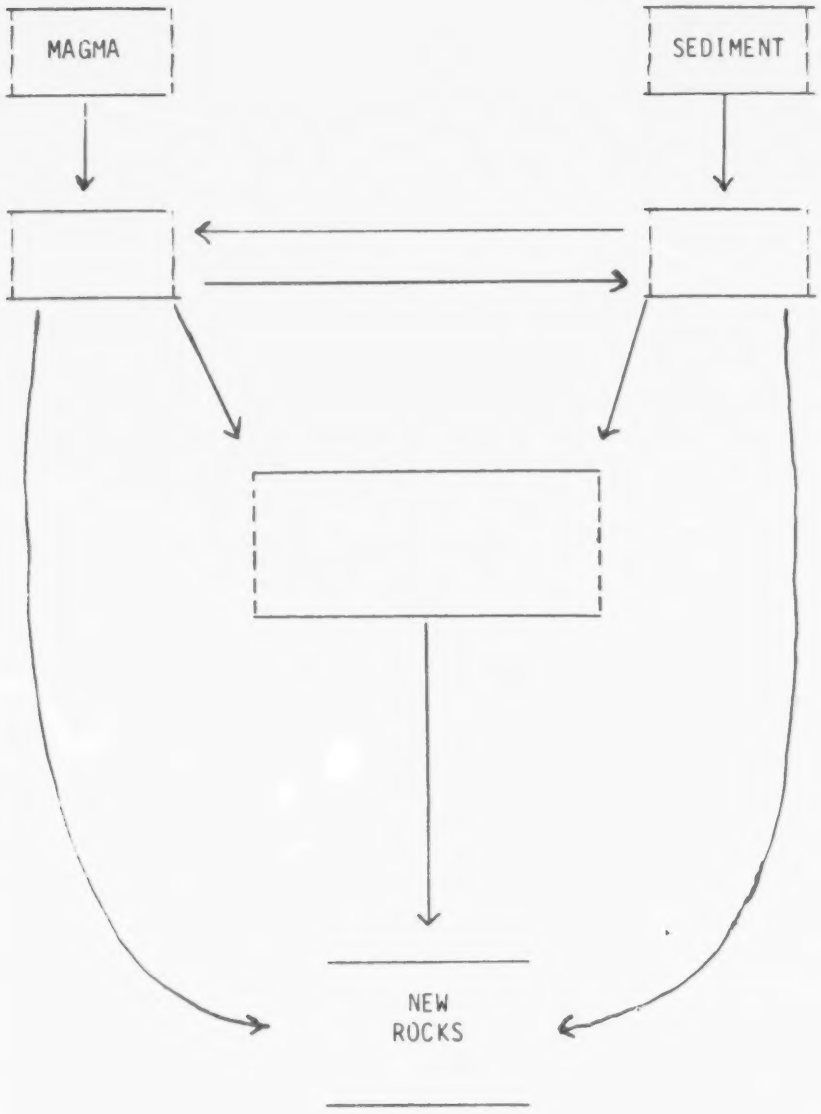
7. Have students find the rocks that look like the three samples on display. Identify the rocks that each was changed into during the Rock Cycle.

8. Draw the following chart on the chalkboard:

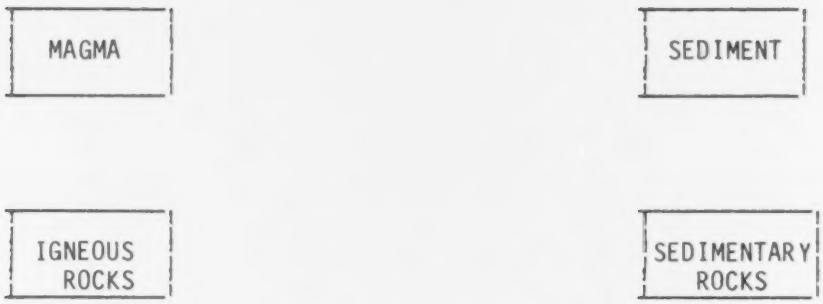
NAME OF ROCK	TYPE OF ROCK	DESCRIPTION
GRANITE	IGNEOUS	Black & White Speckled

9. Instruct students to copy the chart and fill in the appropriate answers.

THE ROCK CYCLE
Handout



THE ROCK CYCLE
Key



GRADE 8
EARTH SCIENCE

UNIT: Earth
TOPIC: Lithosphere
OUTCOME: 71. Discuss physical properties of minerals.
73. Explain how to identify a mineral.

Background

Since there are approximately 2000 minerals in the world, how do geologists tell one mineral from another? Geologists look at certain mineral properties: color, hardness, and luster. This activity helps students learn to use mineral properties to identify six common minerals.

Before beginning the activity, provide six work stations around the classroom. Assign each station a number. Equip each station with a streak plate or piece of porcelain tile, penny, and a pair of steel scissors or steel file. Place a different mineral sample at each work station. Provide for each student the Handout, MINERAL CHART.

Materials

- Samples of quartz, graphite, pyrite, hematite, galena, and halite
- Streak plates or pieces of porcelain tile, each with an unglazed side (6)
- Pennies (6)
- Pairs of steel scissors or steel files (6)
- Numbered index cards (6)
- Chalkboard or easel paper
- Handout, MINERAL CHART
- Handout, FURTHER FACTS ABOUT MINERALS

Procedures

Procedures 1-5 are teacher demonstrations and procedures 6-8 are student oriented.

1. Explain to students that geologists identify minerals by looking for particular mineral characteristics or properties. Tell students they will attempt to identify common minerals by using the same procedures geologists use. Emphasize to students that geologists use many other tests and more sophisticated equipment. Distribute to each student a copy of the Handout, MINERAL CHART.

2. Display the piece of quartz. Do not identify the mineral. (Quartz is usually colorless or white, but may be pink, smoky-gray, yellow, or purple if it contains impurities.) Direct students to write the color of the mineral sample in the column labeled COLOR on row 1 of the Handout, MINERAL CHART.

BEST COPY AVAILABLE

3. Test the streak or color the mineral leaves behind after scratching the piece of quartz across the streak plate or piece of porcelain tile. (The quartz should leave a white streak.) Point out to students that many minerals leave a streak that is different in color from the mineral itself. Emphasize to students that it is sometimes difficult to recognize the streak of very hard minerals. Direct students to write the color of the streak in the column labeled STREAK on row 1 of the Handout, MINERAL CHART.

4. Change the position of the quartz slowly so that it captures and reflects light. Tell students that luster is the way a mineral reflects light. (The quartz should have a glassy luster that shines like glass.) State to students that other minerals reflect very little light and have a dull luster while still others have a metallic luster that shines brightly. Point out to students that the luster of certain minerals may vary due to the rate of crystal formation. Direct students to write a description of the mineral's luster in the column labeled LUSTER on row 1 of the Handout, MINERAL CHART.

5. Test the quartz for mineral hardness by using the following simplified method.

TEST	HARDNESS RATING
A. Scratched with fingernail	Very Soft
B. Scratched with a penny	Soft
C. Scratched with steel scissors	Medium
D. Not scratched with any of above	Hard

(None of the items used will scratch quartz; therefore, it is considered to be a hard mineral. Results of the mineral hardness tests may vary due to the quality of the mineral samples and student interpretations.) Direct students to write the hardness rating of the mineral in the column labeled HARDNESS on row 1 of the Handout, MINERAL CHART.

6. Group and direct students to repeat the above procedures to determine the characteristics of the five remaining minerals. Have groups move from station to station and fill in the proper spaces on the Handout, MINERAL CHART, with the exception of the mineral names.

7. Copy the key to the mineral chart on the chalkboard or a piece of easel paper. Be certain to list the minerals in the same order as previously presented at the work stations. Ask students to compare and discuss the key answers with their results. If substitutions for minerals in the handout are employed, use a rock and mineral field guide to verify characteristics.

8. Distribute to students copies of the Handout, FURTHER FACTS ABOUT MINERALS. Ask students to read further information about the minerals tested.

MINERAL CHART
Handout

WORK STATION NUMBER	COLOR	STREAK	LUSTER	HARDNESS	NAME OF MINERAL
1.					
2.					
3.					
4.					
5.					
6.					

MINERAL CHART
Key

WORK STATION NUMBER	COLOR	STREAK	LUSTER	HARDNESS	NAME OF MINERAL
1.	colorless, white (may have tints of color)	white	glassy	hard	quartz
2.	gray	dark gray	metallic	soft to medium	galena
3.	colorless (may have tints of color)	white	glassy	soft	halite
4.	brassy yellow, gold	blackish	metallic	hard	pyrite
5.	gray	gray, black	dull, metallic	very soft	graphite
6.	red, brown, gray, black brown	dark red, reddish-brown	dull, metallic	medium to hard	hematite

FURTHER FACTS ABOUT MINERALS
Handout

#1 QUARTZ	#2 GALENA	#3 HALITE
. common mineral . used to make glass and many other products . can form gemstones such as amethysts when it contains impurities	. major source of lead . often forms cube-shaped crystals	. its Greek name means "salt" . same substance we use to flavor food
#4 PYRITE	**#5 GRAPHITE**	**#6 HEMATITE**
. commonly known as "fool's gold" because its crystals are gold-colored . often occurs near real gold	. comes from Greek word meaning "to write" . used to make writing points in pencils . often called "lead" by mistake . often used as a lubricant	. the most important source of iron . a source of red pigment

GRADE 8
EARTH SCIENCE

UNIT: Earth
TOPIC: Lithosphere
OUTCOME: 72. Compare and contrast rocks and minerals.

Background

Minerals are solid, inorganic, formed in nature, and have definite crystalline forms and chemical compositions. Minerals, in combination, form rocks and are divided into several groups according to their chemical compositions. The larger mineral groups are silicates (SiO_2), carbonates (CO_3), and oxides (O).

Rocks may be organic or inorganic and are formed by combinations of minerals. The kind of rock that forms from certain minerals is determined by the environment. There are three groups of rocks classified by their origin. If layering occurs with minerals, sedimentary rock will form. If a rock is compressed or foliated, a metamorphic rock will form. Igneous rocks are formed from the solidification of magma and lava.

The best way to differentiate a rock from a mineral is to separate and then identify the minerals that constitute the rock. This activity teaches students how to differentiate the rock and pegmatite from the minerals that form it. Pegmatite is chosen for this activity because the minerals that form it make identification easier.

Materials

- Large and small specimens of pegmatite
- Hand specimens of various rocks
- Chalkboard

Procedures

1. Write on the chalkboard the names feldspar, quartz, hornblende, and mica.

2. Display the pegmatite. Ask students to identify the kind of rock pegmatite represents. (igneous)

3. Explain to students that pegmatite is an igneous intrusive rock that formed by cooling slowly within the earth and provided time for the crystals to grow.

4. Identify the minerals in the pegmatite by color: pink-tan/feldspar, white/quartz, black/hornblende, and shiny black/mica.

5. Identify the mineral group to which each of the pegmatite minerals belongs. Quartz, feldspar, hornblende, and mica are silicates.

GRADE 8
EARTH SCIENCE

UNIT: Earth
TOPIC: Lithosphere
OUTCOME: 74. Name and describe the three major parts of the earth.

Background

The lithosphere is the solid part of the land areas of the earth. The hydrosphere is the part of the earth where water is found and includes oceans, lakes, running water, and ground water. Three-quarters of the earth's surface is covered by water. The atmosphere is the gaseous envelope that surrounds the earth and extends outward into space. The atmosphere is divided into four layers. The first layer is called the troposphere and extends from the surface of the earth upward to about 16 kilometers. In this layer, weather originates. The second layer is called the stratosphere. It contains a layer of gas known as ozone which protects the earth from harmful radiation. The third layer, or the mesosphere, is the coldest, with temperatures approximately -100°C in the upper ranges of the layer. The fourth layer, or thermosphere, has two parts: the ionosphere and the exosphere. This layer contains ions which reflect radio waves back to earth. It is the warmest layer because of absorption of the sun's energy.

Materials

- Transparency of Handout, MAJOR PARTS OF EARTH
- Handout, MAJOR PARTS OF EARTH
- Globe (optional)

Procedures

1. Before beginning the activity, instruct students to read material in a textbook on lithosphere, hydrosphere, and atmosphere. Have students make notes of important points for class discussion.

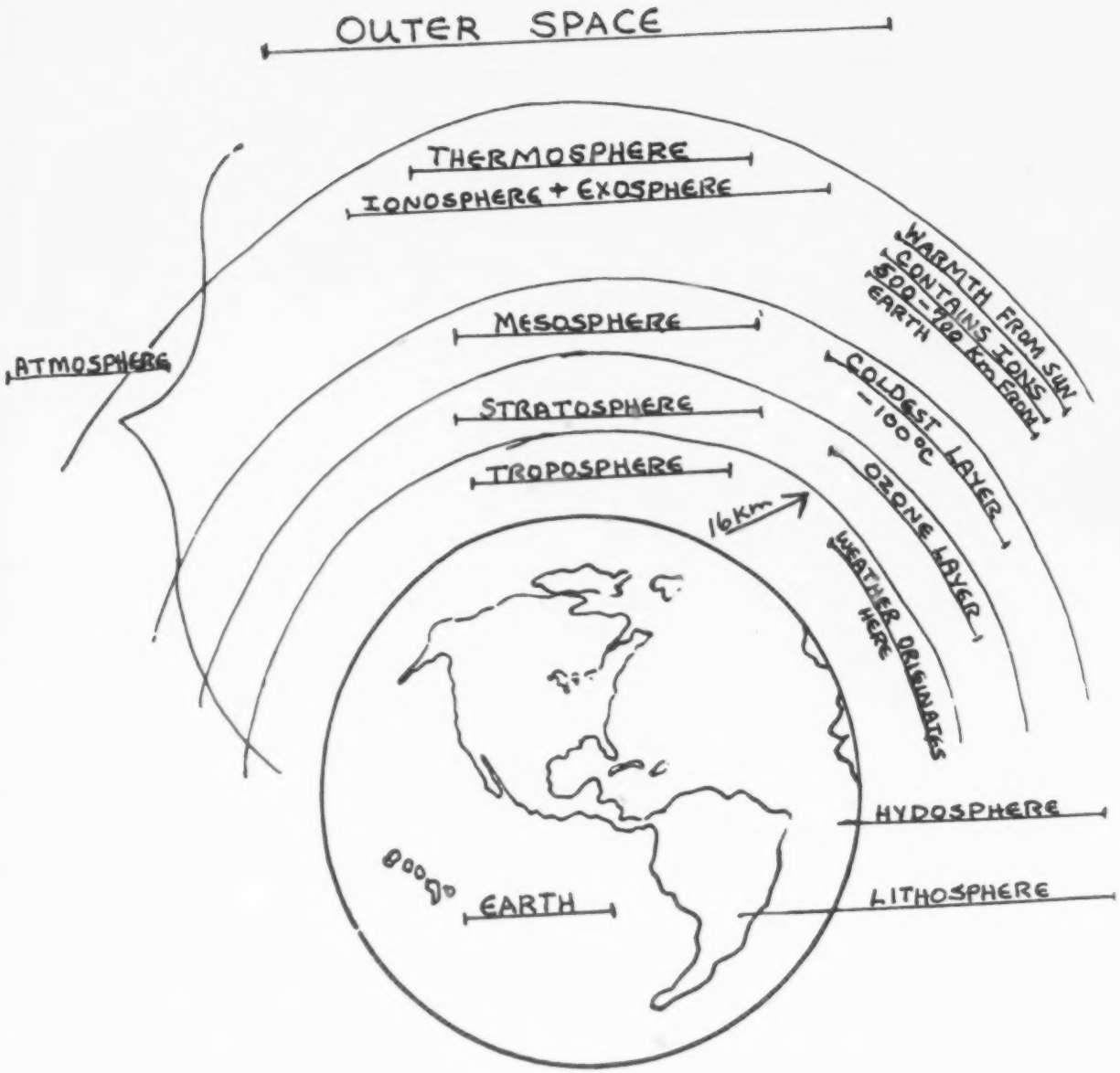
2. Give each student a copy of the Handout, MAJOR PARTS OF THE EARTH.

3. Using a transparency, MAJOR PARTS OF THE EARTH, discuss the parts of the earth, soliciting comments from students and having students fill in the blank spaces on the handout as shown on the key. Include current information such as destruction of the ozone layer.

4. Inform students that the topic for the following day will be the lithosphere (Outcome 75).

MAJORS PARTS OF EARTH
Handout

MAJOR PARTS OF EARTH
Key



177

GRADE 8
EARTH SCIENCE

UNIT: Earth
TOPIC: Lithosphere
OUTCOME: 75. Diagram the earth's interior.

Background

Much knowledge has been gained as a result of seismic studies. Seismic studies have revealed that there are four distinct layers of the earth's interior: crust, mantle, outer core, and inner core.

The oceanic crust is usually darker and denser in color than the crust of the continents. The principal rock in the oceanic crust is basalt. The major rock in the continental crust is granite. The crust is 32-48 kilometers thick. Compared to the mantle, it is very thin.

The mantle lies below the crust. Part of this layer is melted. The top of the mantle seems to flow more than the bottom. It is believed to consist of iron-rich rocks. It extends from the crust to nearly 2900 kilometers into the earth's interior. The mantle is divided into three layers: the lower lithosphere, the aesthenosphere, and the mesosphere.

The third layer of the earth is the outer core. It is mostly iron and nickel in a hot "plastic" or fluid state. It is about 1350 kilometers thick.

The fourth layer, or the inner core, makes up the center of the earth and is thought to be mostly solid iron. It is about 1500 kilometers thick. Pressure in this layer is tremendous.

Materials

- Construction paper (yellow, brown, green, red)
- Rulers
- Glue
- Plastic foam meat trays
- Handout, PATTERN FOR CROSS-SECTION OF EARTH
- Gummed labels
- Toothpicks
- Scissors

Procedures

1. Divide students into groups. Give each group a meat tray, small pieces of each color of construction paper, glue, toothpicks, gummed labels, and the Handout, PATTERN FOR CROSS-SECTION OF EARTH.

2. Direct each group to make a model of the earth's interior by first tracing the pattern on the meat tray and then tracing the different sections on the construction paper. Tell students to use the colors as follows:

Crust - green

Mantle - brown

Outer core - orange

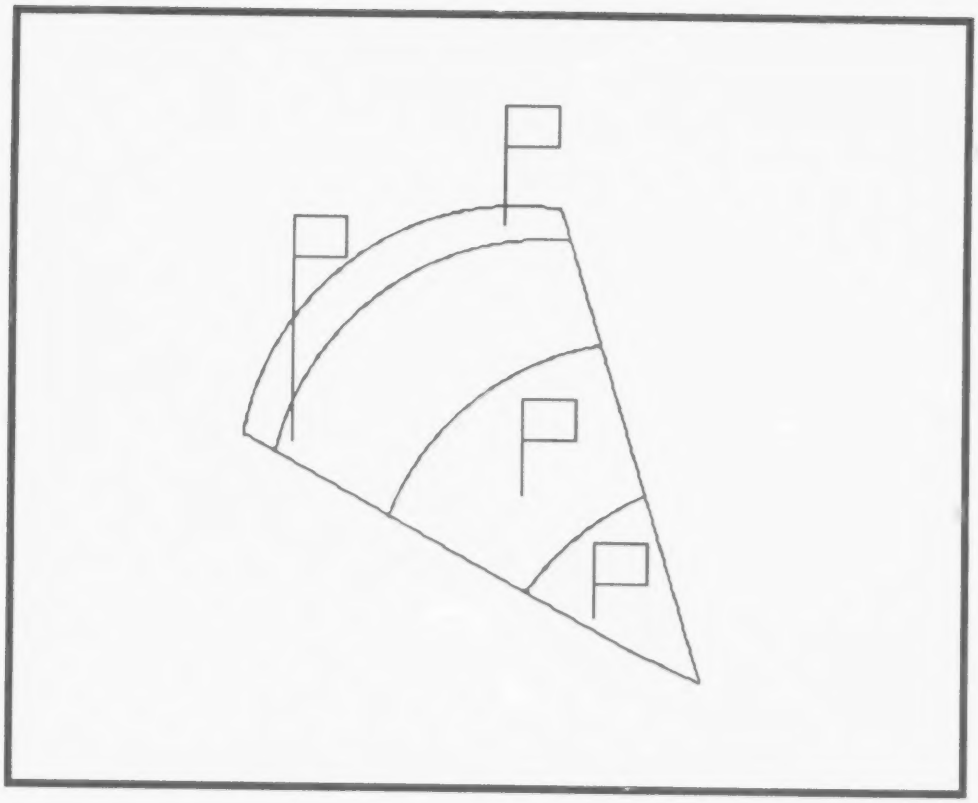
Inner core - yellow

3. Have the groups cut out the sections and glue the sections on the meat tray in the correct locations.

4. Have students label the sections by writing the name of each section on a label, wrapping the label around a toothpick, and sticking the toothpick in the correct position on the tray.

5. Discuss the layers of the earth's interior with students.

PATTERN FOR CROSS-SECTION OF EARTH
Handout



GRADE 8
EARTH SCIENCE

UNIT: Earth
TOPIC: Lithosphere
OUTCOME: 76. Explain how astronomy provides indirect evidence about the earth's interior.

Background

The deepest hole ever drilled into the earth is eight miles in depth; therefore, there is no exact proof of the composition of the earth's interior. Scientists do, however, infer evidence about the earth's interior from knowledge gained through study of other bodies in our solar system. The composition of the moon and of meteorites gives indications about common materials in the universe. Spectroscopy of stars and other planets have proven that these bodies contain the same elements as the earth.

Satellite imagery, the science of collecting data about Earth from the air or from space, is called "remote sensing." This activity has provided much information about the interior of the earth.

Materials

- Shoe box with lid
- Reference books or encyclopedias on astronomy
- Large box with small opening cut in the top
- Small items such as a spoon, spool, rock, sponge, marble, ping pong ball
- NASA film titled Remote Sensing

Procedures

1. Prior to beginning the activity, place three small items in the large box and a similar set of items in the shoe box.

2. Have students feel and identify the items in the large box.

3. Discuss how students were able to identify the items. (Answers should indicate past experience with the items.)

4. Have several students shake the closed shoe box.

5. Ask students to determine the contents of the shoe box and tell how they arrived at their answers. (Answers should indicate a link with the materials in the larger box.)

6. Tell students that this is an example of indirect evidence. Explain to students that indirect evidence provides clues to the identity of something.

7. Discuss with students the fact that knowledge gained about the interior of the earth is partially due to the evidence gained from other heavenly bodies, based on indirect evidence.

8. Show students the NASA film titled Remote Sensing. Discuss the film.

9. Have students research the topography of the moon or another planet and write a paper comparing its similarity to Earth.

GRADE 8
EARTH SCIENCE

UNIT: Earth
TOPIC: Lithosphere
OUTCOME: 77. Identify major causes of earthquakes.

Background

This activity helps students understand how stress creates earthquakes and what forms when the earth reaches its breaking point and a fault is created. The forces of tension, shearing, and compression will be simulated using cornstarch. Before beginning the activity make a bulletin board of recent newspaper articles about earthquakes. Discuss earthquakes with students.

Materials

- Cornstarch
- Water
- Flour
- Paper towels
- Test tubes
- Wax paper
- Cork or rubber stoppers
- Plastic cups (1 oz. size)
- Picture of San Andreas Fault
- Sheets of acetate
- Acetate marking pens (black and red)

Procedures

1. Prior to classroom instruction, mix two boxes of cornstarch with water until the mixture is the consistency of thick pudding. Pour the mixture into test tubes and place a cork in each test tube.

2. Show students a picture of the San Andreas fault. Explain that the west coast of California lies on one side of the fault line and the eastern boundary of California lies on the other side of the fault line. Assure students that no section of California is going to "fall into the ocean." However, tell students that once a fault line has formed, earthquakes are more likely to occur along the fault line.

3. Divide students into groups and equip each group with 12 inches of wax paper, a plastic cup of flour, and a test tube of the cornstarch mixture.

4. Instruct the groups to place the wax paper in front of them, lightly sprinkle flour over a four inch surface of the wax paper, and then pour the cornstarch mixture on top of the flour, allowing it to flow freely.

5. Have one student in each group slowly push the cornstarch mixture from one side while another student slowly pushes the mixture from the other side. Direct students to note what occurs. Inform students that this is an example of compression.

6. Have students add flour to the cornstarch mixture until it loses its shine and forms the mixture into a long, narrow mound.

7. Have one student from each group select a location on the top of the mound and pinch it with a thumb and an index finger until a crack occurs on the top. Inform students that this is an example of tension.

8. Instruct each group to reform the cornstarch mixture into a mound. Direct one student from each group to place one hand on each side of the mound. Move the left hand upward while moving the right hand downward. Ask students to observe the results of the movement. Inform students that this is an example of shearing as seen in the San Andreas fault in California.

9. Review compression, tension, and shearing as the three major causes of earthquakes.

GRADE 8
EARTH SCIENCE

UNIT: Earth
TOPIC: Lithosphere
OUTCOMES: 78. Tell what instrument is used to measure an earthquake.

Background

A seismograph is a sensitive instrument that measures and records seismic waves, or tremors, within the earth. Seismographs are motion responsive when anchored to bedrock. A pen marks a zigzag line on a revolving paper roll when seismic waves shake the earth's interior. A weight is suspended on a wire as the reference point, a fixed frame is anchored to the earth, and the weight is suspended from this frame. The revolving cylinder moves which allows lines to be traced on the recording tape of the seismograph. A seismogram is the record of an earth tremor made by a seismograph.

Seismic stations use three instruments to obtain accurate readings. One instrument records east-west horizontal movements, one records north-south horizontal movements, and the third records vertical movements.

A number from one to ten measured by a Richter Scale indicates the intensity of an earthquake. An increase of just one number on the scale means an increase of 30-50 times in the energy released by an earthquake. Another scale called the Mercalli Scale is also used to indicate intensity of earthquakes. This scale does not use instruments but is based on observations by people.

Materials

- Overhead projector
- Marking pen
- Transparencies of Handouts, HORIZONTAL SEISMOGRAPH and VERTICAL SEISMOGRAPH
- Handout, HORIZONTAL SEISMOGRAPH
- Handout, VERTICAL SEISMOGRAPH
- String
- Washer

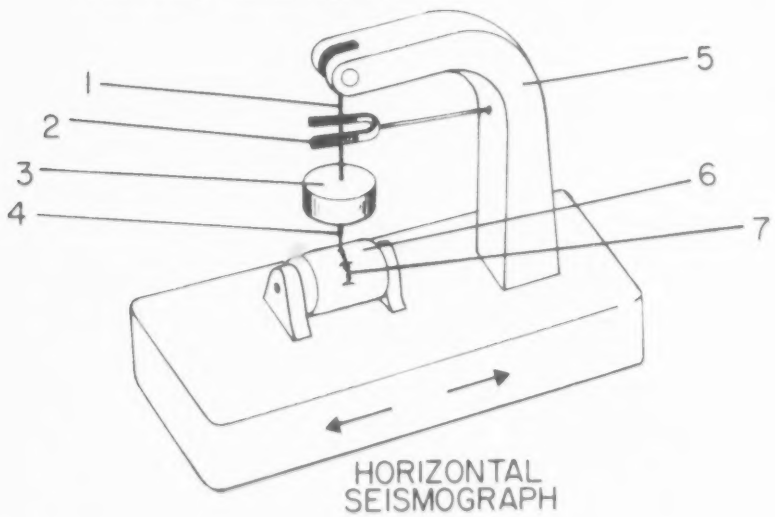
Procedures

1. Give each student a copy of the Handout, HORIZONTAL SEISMOGRAPH. Explain to students the parts of the seismograph and assist students in labeling each part. Explain to students the use of the seismograph in measuring north-south and east-west movements of the earth.

2. Using the overhead projector, demonstrate the horizontal motion with the string and washer.

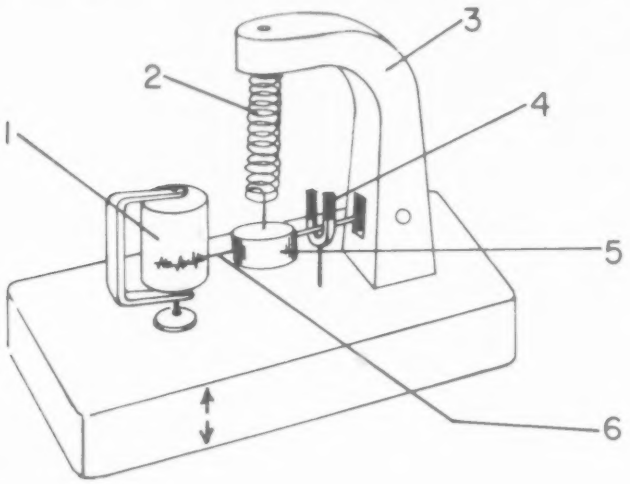
3. Give each student a copy of the Handout, VERTICAL SEISMOGRAPH. Repeat instructions 1 and 2.

Directions: On the diagram below label the seven parts of a Horizontal Seismograph



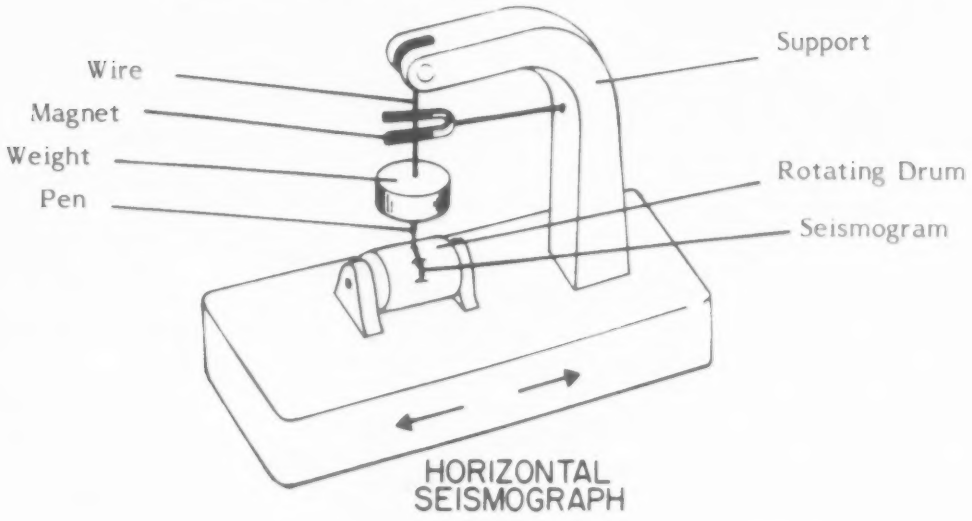
VERTICAL SEISMOGRAPH
Handout

Directions: Label 1-6 on the diagram below to identify the parts of a Vertical Seismograph

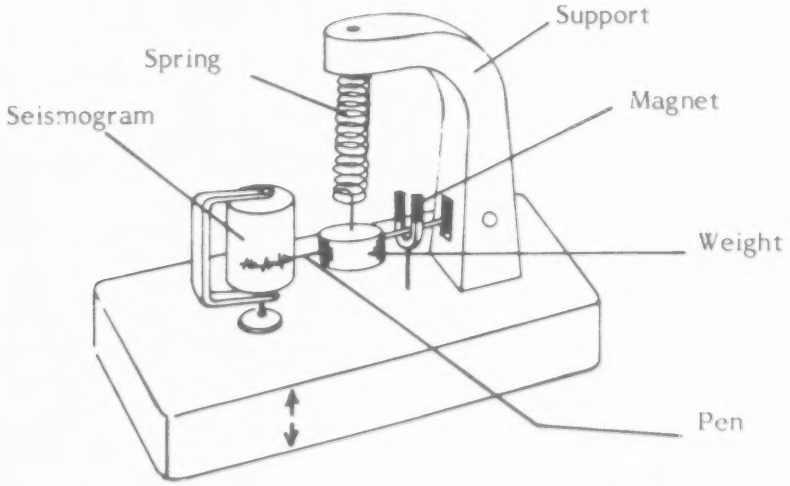


HORIZONTAL AND VERTICAL SEISMOGRAPHS
Key

Directions: On the diagram below label the seven parts of a Horizontal Seismograph



Directions: Label 1-6 on the diagram below to identify the parts of a Vertical Seismograph



GRADE 8
EARTH SCIENCE

UNIT: Earth
TOPIC: Lithosphere
OUTCOME: 79. Explain three types of seismic waves.

Background

Seismic waves created by earthquakes are wave-like motions produced by vibrations within the earth. There are three types of seismic waves.

1. Primary waves (P waves):
   - Caused by a sudden slip along a fault
   - Cause individual particles to vibrate back and forth in the direction of the wave
   - Arrive at the surface of the earth before S waves
2. Secondary waves (S waves):
   - Vibrate up and down at right angles to P waves
3. Surface waves (L waves):
   - Travel along the earth's surface
   - Guided by outer layers of earth
   - Have the greatest height
   - Last waves to reach the seismic station

Materials

- Overhead projector
- Transparency of Seismic Waves
- Rope
- Slinky
- Glass dish
- Aluminum wire #34
- Dowel rods (1 inch diameter)
- Shoestrings (18 inch)
- Petri dishes
- Beakers (small)
- Brown construction paper

Procedures

1. Explain to students that this activity involves observing and demonstrating simulations of three types of seismic waves.

2. Show the transparency of Seismic Waves and point out the P waves. Place the rope on a table while holding one end of the rope. Make a jerking motion with the rope. Have students observe the rope and describe the motion. Tell students P waves make this type motion.

3. Place the slinky on a table. While holding one end of the slinky, make a jerking motion. Pluck the spring quickly in a vertical direction to the table until a back and forth motion results. Tell students that this illustrates the motion made by an S wave. Point out the location of S waves on the transparency.

4. Fill and place the glass dish with water on the overhead projector. Slide the dish approximately 1/4 inch so that the water moves. Have students observe and describe the motion of the water. Tell students this illustrates the motion made by L waves. Point out the location of L waves on the transparency.

5. Divide students into groups. Equip each group with a shoe string, 36 inches of wire, dowel rod, petri dish, and small beaker of water.

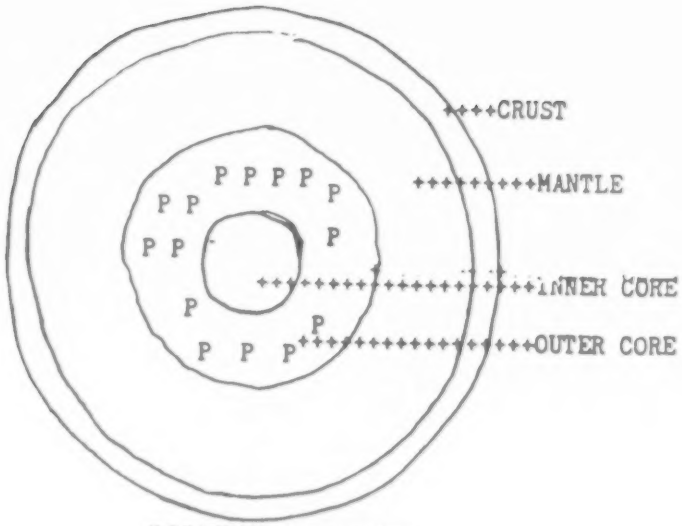
6. Instruct students to simulate the movement of P waves with the shoestring.

7. Direct students to wind the wire tightly and evenly around the dowel rod and then slip it off. Have students use the wire to simulate the motion of S waves.

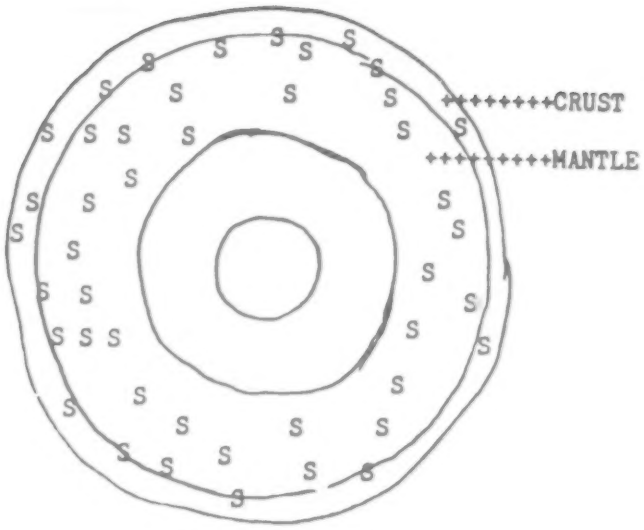
8. Have students fill a petri dish with water and slide the dish about 1 1/2 inches to simulate the motion of L waves.

9. Review the three types of seismic waves and the motion of each type.

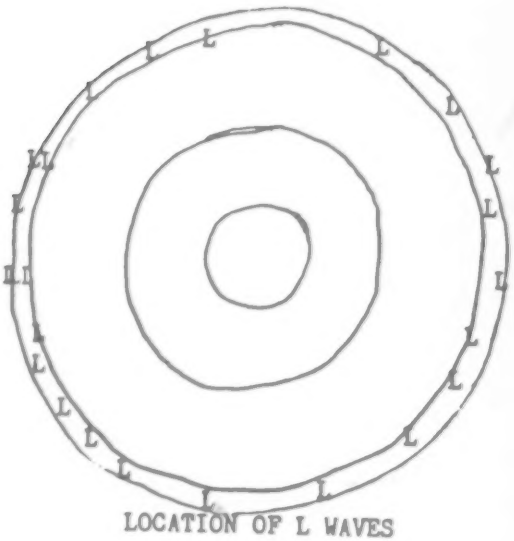
SEISMIC WAVES



LOCATION OF P WAVES



LOCATION OF S WAVES



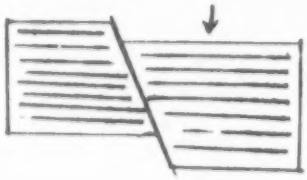
LOCATION OF L WAVES

GRADE 8
EARTH SCIENCE

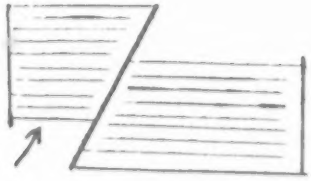
UNIT: Earth
TOPIC: Lithosphere
OUTCOMES: 80. Define mountain range.
81. Define fault, folding.
82. Discuss types of faults.

Background

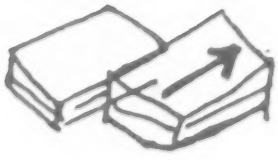
Mountains are caused by faults or folds in the earth's surface. Folds occur when layers of rock are compressed from side to side. Faults are described as cracks in the crust of the earth. There are three types of faults which may be produced depending upon the direction in which the rock layers slip: Normal,



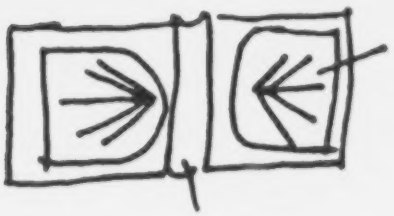
Reverse, and



Horizontal.



Before beginning the activity, purchase enough miniature Nestle Crunch Bars for each student to have at least one bar. (Nestle Crunch bars are used because of the unique shape and arrow imprint required for demonstration.)



"fault"

arrows for direction of "rock layer" movement.

Nestle Crunch bars resemble the color of dirt and comes complete with crisp rice pieces or "rocks."

Materials

- Miniature Nestle Crunch bars

Procedures

1. Lead the class in a discussion of faulting. Emphasize to students the direction of rock layer movement which produces each of the three types of faults.

2. Distribute the Nestle Crunch bars to each student. Instruct students to unwrap the "piece of the earth's crust".

3. Through the use of leading questions, guide students to observe the "fault" line in the middle of the crust and the arrows indicating the "direction of crustal movement".

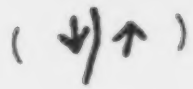
4. Instruct students to break the piece of candy along the fault line. Demonstrate the various directions the pieces of crust move to create the different types of faults.

5. Direct the students to create an "earthquake" by pushing the two candy pieces together and allowing one piece of the crust to slip.

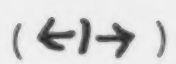
Variation

1. Use the Nestle Crunch bars to teach plate tectonics by designating each piece of the candy to represent a crustal plate of the earth with the arrows giving the directions of the plate movement as follows:

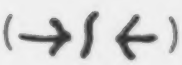
(1) Transform fault,



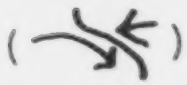
(2) Diverging,



(3) Converging, and



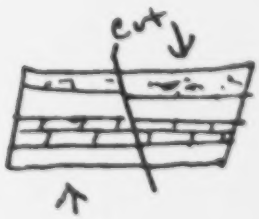
(4) Subduction Zone.

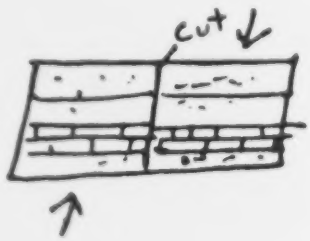


2. Use caramels to represent the aesthenosphere, a plastic-like layer between the crust and the mantle.

3. Use clay, construction paper, or carpet pieces to represent layers of rock.

4. Use index cards to draw and color rock layers. Cut the cards apart as shown and move the pieces of the cards to demonstrate the direction of crustal movement.





GRADE 8
EARTH SCIENCE

UNIT: Earth
TOPIC: Lithosphere
OUTCOMES: 81. Define fault, folding.
83. Identify two major types of folds.

Background

Mountains are caused by the compression, breaking, or melting of rock layers. Faults are cracks in the crust that break the continuity of a rock layer. When layers of rock are compressed (→ ←) they tend to fold or bend (→ ←). There are two main types of folds:

anticlines (upward arching) and synclines (downward sinking). This activity will demonstrate that compression on each end of an object, or layer of objects, will cause anticlines and synclines to be formed. Upon completion of this activity, a correlation can be made to plates of the earth being compressed to form folded mountains such as the Rockies, Appalachians, and the Himalayas.

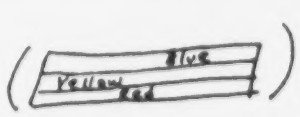
Materials

- Smooth surface such as desk or table top
- Rolling pin or smooth glass jar
- Several colors of modeling clay
- Paper
- Pencils
- Rulers
- Dull kitchen knives
- Pieces of wood, 2" X 4", 1 foot long

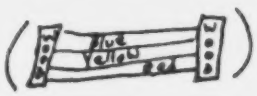
Procedures

1. Divide the class into groups. Equip each group with clay and two pieces of 2"x4" wood.

2. Instruct students to roll the clay into long sheets approximately 1/4" thick, and use the knife to cut the clay into sheets measuring 3" wide x 14" long x 1/4" thick.

3. Have students stack the sheets of clay. (

)

4. Instruct one student in each group to brace one end of the clay with a 2"x4" piece of wood  and another student from the group to begin gently pushing another 2"x4" piece of wood against the opposite side of the stack of clay.

5. Have students press the clay until the two pieces of wood are approximately 8" apart.

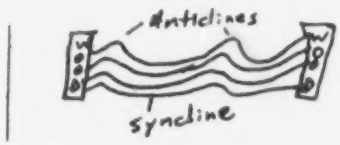
6. Instruct students to sketch the folding clay and label the anticlines and synclines.

7. Discuss with students the process of folding which resulted in forming the Himalayas, Rockies, and Appalachians.

Variations

1. Use other materials instead of clay such as carpet, cardboard, or construction paper in 3" by 14" strips.

2. Have students press the ends of the material toward the center at the same time.



GRADE 8
EARTH SCIENCE

UNIT: Earth
TOPIC: Lithosphere
OUTCOMES: 84. Define volcano.
88. Discuss volcanoes that have erupted.

Background

Volcanoes occur when hot molten magna deep in the earth's crust bursts through rock layers and flows out to the surface. Approximately 1,000 volcanoes are currently active on the earth. Some volcanoes erupt violently while others slowly ooze lava. In 1980, Mt. St. Helens in the state of Washington erupted with a force as great as 300 nuclear bombs the size of the 1945 Hiroshima attack, and displaced 4 cubic kilometers of earth. This activity will help students compare the intensity of the eruptions of various volcanoes.

Materials

- Pencil
- Colored pencils
- Graph paper
- Ruler
- Handout, VOLCANO DATA SHEET

Procedures

1. Instruct students to draw a vertical and a horizontal axis on the lower left part of a piece of graph paper. The horizontal axis will represent the volcano and the date of the eruption. The vertical axis will represent the amount of material ejected. Remind students to allow enough space on the outside of the axes to label the volcanoes and the amount of material ejected.

2. Direct students to label the y-axis (↑) AMOUNT OF MATERIAL EJECTED and the x-axis (→) VOLCANO AND DATE OF ERUPTION.

3. Distribute to students the Handout, VOLCANO DATA SHEET.

4. Instruct students to calculate the increments that each block of the y-axis will represent. (Remember the scale must go to at least 80 so increments of 2 or 4 are the best choices.)

5. Have students number the y-axis, remembering that the corner or beginning point is zero.

6. Instruct students to label the x-axis with each of the volcanoes, skipping a column between each volcano.

7. Direct students to draw a representative bar for each volcano on the graph.

8. Have students color the bars making certain that all the eruptions of the same volcano are the same color.

9. Lead the class in a discussion concerning the harmful effects of a volcanic eruption (poisonous gases, ash, mudflows, lava flows, blast damage).

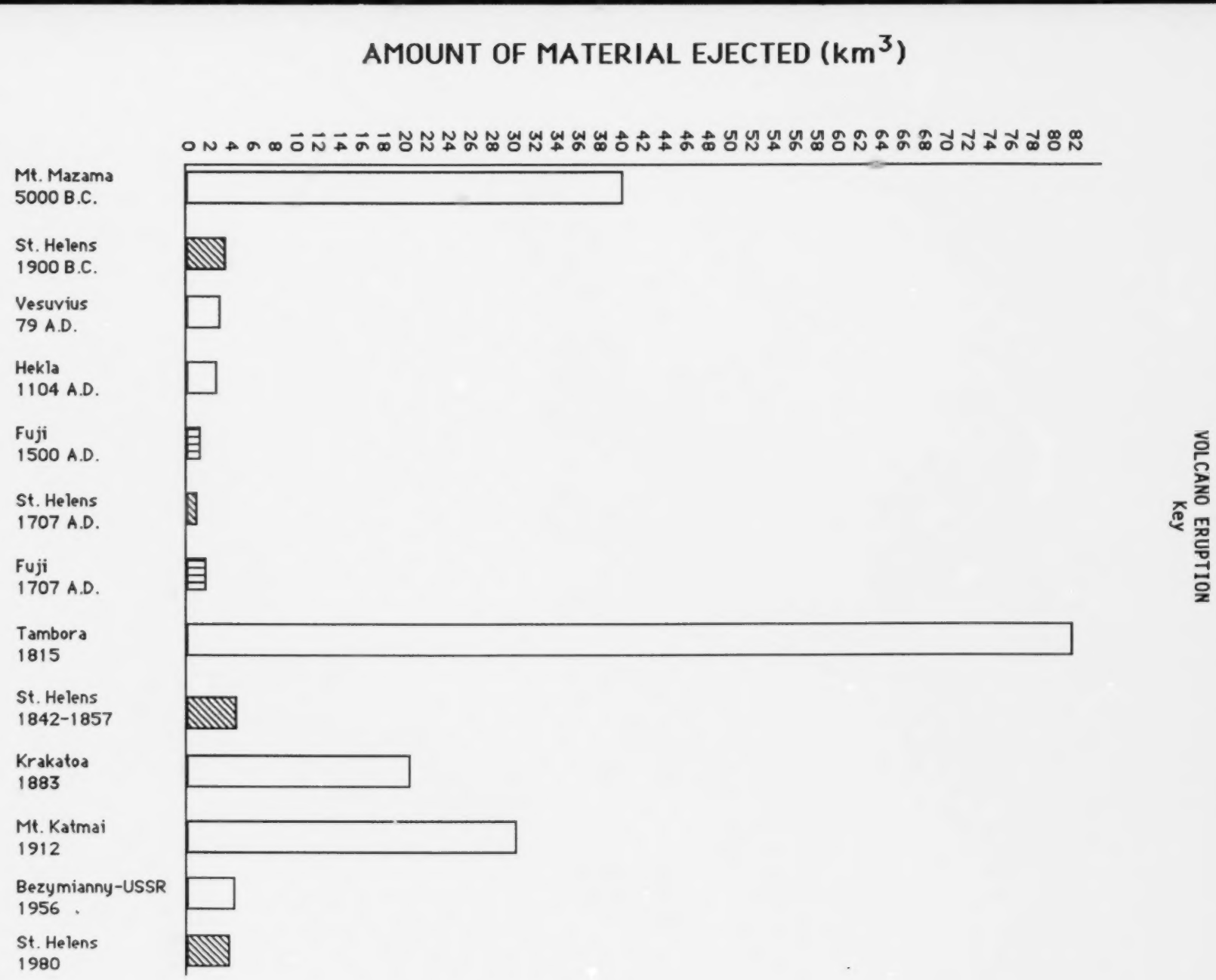
VOLCANO DATA SHEET
Handout

Figure #1

Volcano	Date of eruption	Amount of Material Ejected (km^3)
Mt. Mazama (Crater Lake, OR)	5000 B.C.	40.
Mt. St. Helens (Washington)	1900 B.C.	3.3
Vesuvius (Italy)	79 A.D.	2.7
Hekla (Iceland)	1104 A.D.	2.
Fuji (Japan)	1500 A.D.	1.2
Mt. St. Helens (Washington)	1707 A.D.	1.
Fuji (Japan)	1707 A.D.	1.4
Tambora (Indonesia)	1815 A.D.	80.
Mt. St. Helens (Washington)	1842-1857 A.D.	1.3
Krakatoa (South Pacific)	1883 A.D.	20.
Mt. Katmai, Alaska	1912 A.D.	30.
Bezymianny, USSR	1956 A.D.	4.2
Mt. St. Helens (Washington)	1980 A.D.	4

Source

Health Earth Science, U.S. Geologic slide, and Margena Garrett.


AMOUNT OF MATERIAL EJECTED (km3)
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48 50 52 54 56 58 60 62 64 66 68 70 72 74 76 78 80 82
Mt. Mazama 5000 B.C.
St. Helens 1900 B.C.
Vesuvius 79 A.D.
Hekla 1104 A.D.
Fuji 1500 A.D.
St. Helens 1707 A.D.
Fuji 1707 A.D.
Tambora 1815
St. Helens 1842-1857
Krakatoa 1883
Mt. Katmai 1912
Bezymianny-USSR 1956
St. Helens 1980
VOLCANO ERUPTION
Key

200

GRADE 8
EARTH SCIENCE

UNIT: Earth
TOPIC: Lithosphere
OUTCOMES: 84. Define volcano.
85. Generalize how volcanic mountains are made.
86. Describe geologic features produced by magma in crust.
87. Demonstrate formation of a volcano.

Background

When hot molten magma deep in the earth's crust bursts through surface plates of rock, a volcano occurs. When magma reaches the surface of the earth, it is called lava. Lava cools and forms crystalline formations. These formations of hardened lava, along with bits and pieces of rock thrust up by pressure, often create a mountain of rock or volcanic mountain.

We can safely simulate hot molten magma and its cooling crystalline form using the chemical thymol. Thymol has a low melting point and, on cooling, forms interesting crystals. This activity should be completed as a teacher demonstration, allowing groups of students to observe at close range.

Materials

- Petri dishes (3)
- Hot plate
- Ice cubes
- Microscope
- Thymol

Procedures

1. Place an equal quantity of thymol into each of three petri dishes. Melt the thymol on a hot plate set at low temperature.

2. Allow one petri dish to cool slowly. Rapidly cool a second petri dish by placing it on ice cubes. Have students observe the effect the rate of cooling has on crystal formations.

3. After cooling, place the third petri dish under a microscope to better observe the crystal formations. Discuss the formations with students.

GRADE 8
EARTH SCIENCE

UNIT: Earth
TOPIC: Lithosphere
OUTCOME: 89. Explain how radioactive dating is used to estimate the age of the earth.

Background

Determining the age of fossil remains is often thought of as a difficult concept to teach. This activity is designed to tangibly demonstrate how radiocarbon (carbon-14) dating is accomplished. Throughout the life of an organism, new carbon-14 atoms are added almost as rapidly as older carbon-14 atoms breakdown into nitrogen-14 atoms. A steady or consistent ratio is maintained between the carbon-14 atoms and ordinary carbon-12 atoms throughout the life of an organism. When the organism dies, carbon-14 atoms will no longer be added, but will begin to breakdown into nitrogen-14 thereby causing the ratio between c-14 and c-12 to begin to change. One half of the carbon-14 atoms will break down 5,730 years after death. The number of carbon-12 atoms will not change.

Before beginning this activity fill each jar with 64 one-half inch nuts.

Materials

- Pencil
- Paper
- 3 large beakers or quart jars (500 ml)
- 192 one-half inch nuts or large beans
- Timer

Procedures

1. Divide the class into three large groups.

2. Distribute the jars of 1/2" nuts and tell students that the jar represents an object that has just died.

3. Instruct students to count the number of nuts in the jar and record this information.

4. After three minutes, instruct students to remove one-half of the nuts and place them in a pile off to the side. (32 nuts should be left in the jar.)

5. After three more minutes, instruct students to again remove one-half of the nuts left in the jar and place these in a pile to the side separate from the first pile. (16 nuts should be left in the jar.)

6. Direct the students to repeat this process for two more three minute increments. (Eight nuts should be left in the jar and finally only four nuts.) Each group of nuts must remain in separate piles.

7. Instruct students to count the number of piles and record this information. (Each pile represents one half-life of carbon-14.)

8. Direct students to multiply 4 (the number of half-lives) by 5,730 (the number of years of one c-14 half-life) to determine the age of the "fossil jar." (4 x 5,730 = 22,920 years old.)

Variation 1

Use a variety of jar shapes to represent a variety of fossils. Assign groups different amounts of time, three minute increments or two minute increments. After this activity discuss the law of superposition. (Oldest layers and fossils are on the bottom layers of earth and younger layers and fossils are on the top.)

Variation 2

Use a variety of materials to fill the jars (peanuts, screws, paper clips).

Variation 3

Provide students with different numbers of nuts and have each group proceed with the activity and apply the formula to determine the ages of their assigned "fossils."

GRADE 8
EARTH SCIENCE

UNIT: Earth
TOPIC: Lithosphere
OUTCOMES: 90. Define fossil.
91. Explain how fossils are formed.
92. Describe the natural method of fossil formation.

Background

The formation of rock around the remains of an organism or object is a slow process that produces fossils. Often the process obscures or hides the object and prevents study which would allow a better understanding of the past. In this activity students discover how fossils are formed. Students will be exposed to the difficulties involved in trying to remove rock from fossil remains. Formation of molds should be pointed out as students attempt to retrieve the fossils.

Materials

- Potter's clay
- Several pieces of inexpensive costume jewelry
- Several chicken bones or other small bone pieces
- Kiln or oven
- Hammer
- Pot holders

Procedures

Prior to the day the class is to be taught:

1. Bury the chicken bones and several pieces of the jewelry in blocks of clay. Make all blocks as close to the same size as possible to hide any clues that might reveal the kind of fossil buried inside.

2. Using several blocks of clay, make a mold of selected pieces of costume jewelry on the outside of the blocks. Press the jewelry into the clay and then remove the jewelry leaving its imprint.

3. Bake all the blocks in a kiln for 5 hours until the clay is hard. (If a conventional oven is used, bake for 5 hours at 500^{o}F) Allow the blocks to cool overnight.

On class day:

1. Lead the class in a discussion of fossil formation. Ask what difficulties might be involved in finding and recovering fossils. Tell students that there are fossils buried in the clay rocks from an "ancient civilization" and that their assignment is to carefully retrieve the fossils.

2. Instruct students to examine the rocks carefully and record their observations of the molds on the outside. Have students then open the rocks using the pick hammer and retrieve the fossils.

3. Direct students to speculate what life was like in the "ancient civilization" based on the fossils.

4. Discuss with the class the difficulties paleontologists and other scientists face in speculating about the past history of the earth based on fossils.

Variations

1. Use plaster of Paris instead of clay.

2. Use plaster of Paris to make casts of the molds.

3. Use various kinds of materials other than bone and jewelry.

GRADE 8
EARTH SCIENCE

UNIT: Earth
TOPIC: Lithosphere
OUTCOMES: 90. Define fossil.
91. Explain how fossils are formed.
92. Describe the natural method of fossil formation.

Background

Fossils are formed when the remains of organisms are buried and the organisms decay leaving a thin film of carbon imprinted on a rock formation. Leaf fossils are formed in this manner. In this activity students observe models of leaf fossils, but the models are not produced by the natural decaying process.

This activity is a teacher demonstration.

Materials

- Typing paper
- 2 or 3 different types of leaves
- Candle in a holder
- Large beaker (100 ml) or jar with a smooth surface on bottom
- Goggles
- Hot mitt or heatproof glove
- Tweezers
- Paper towels
- Petroleum jelly
- Matches
- Apron

Procedures

1. Cover the body and eyes with the apron and safety goggles. Make certain that all clothing is secure and will not come in contact with a flame.

2. Coat the outside bottom of the beaker with a thin layer of petroleum jelly. Turn the beaker upside down on a paper towel.

3. Make the candle secure in the holder. Light the candle.

4. Don the heatproof.glove. Hold the beaker over the candle. Move the beaker around over the flame so that the entire bottom of the beaker will be coated heavily with black carbon.

5. Place the beaker upside down on the paper towel. Allow the beaker to cool for at least 3 minutes.

6. Cut a piece of typing paper the correct size to cover the bottom of the beaker.

7. Remove the stem from a leaf. Place the leaf face down on the beaker. Place a piece of typing paper over the leaf. Hold the leaf and paper firmly with one hand and rub just hard enough to coat the leaf with carbon.

8. Remove the paper and use the tweezers to carefully remove the leaf. Place the leaf on a full sheet of typing paper. Cover the leaf with another full sheet of typing paper.

9. Press down firmly and rub the area where the leaf has been placed.

10. Carefully remove the top sheet of paper and the leaf. (An imprint of the leaf should be left on the paper. Be careful not to smear the image.)

11. Repeat the above procedures with each type leaf.

12. Lead the class in a discussion concerning fossil imprints.

Variation

1. This activity can be completed by student groups instead of teacher demonstration.

2. Charcoal can be used to provide carbon.

GRADE 8
EARTH SCIENCE

UNIT: Earth
TOPIC: Lithosphere
OUTCOMES: 93. Discuss fossil fuels.
94. Interpret geologic time scale.

Background

The three major fossil fuels are petroleum, natural gas, and coal. These fuels were formed millions of years ago from decaying remains of plants and animals combining with great pressures deep below the crust of the earth. For man's purposes, fossil fuels are considered to be nonrenewable resources. The processes of fossil fuel formation are ongoing in nature but the current available supply will soon be exhausted by modern man's tremendous appetite for fossil fuels. Petroleum is a fossil fuel requiring some 300-500 million years to form. How long is 500 million years? This activity is designed to emphasize the pace of geologic time.

Materials

- Adding machine tape
- Meter sticks

Procedures

1. NOTE: On this scale of geologic time, one meter equals one billion years. Therefore, a five meter length of tape is required to represent the probable age of the earth.

2. Divide the class into small groups. Give each group a meter stick and a strip of adding machine tape five meters long.

3. Instruct students to measure the length of the tape (5 meters long). For each meter measurement on the tape, have students mark one billion years.

4. At the three billion year mark, from left to right, tell students to write "oldest known plants." At 3.8 billion years, tell students to write "oldest known animals." (This was the period of time when fossil fuel formation began.)

5. Have students move to the right-side end of the tape and mark the 4.5 billion mark, the estimated age of the earth. Tell students this represents current time and that earliest man is estimated to have appeared on earth about two million years ago. (To scale, two million years would be 0.002 of a meter.) Have students mark this measurement to the left of the 4.5 meter mark. Explain to students that the geologic time scale is complete.

6. Ask students to make a mark on their tape indicating the approximate time Columbus discovered America five hundred years ago.

GRADE 8
EARTH SCIENCE

UNIT: Earth
TOPIC: Lithosphere
OUTCOME: 95. Define landforms.
96. Name major way landforms are constructed.
98. Name major landforms.

Background

Landforms are constructed when pressure within the earth's mantel pushes up rock layers into various forms of crustal formations. Erosion over millions of years produces resulting land formations. Mountains, plains, plateaus, basins and slopes are all examples of landforms.

There are eight regions of the continental United States that generally have distinctive major landforms. The eight regions are the Coastal Plains, Appalachian Highlands, Central Plains, Rocky Mountains, Colorado Plateau, Columbia Plateau, and Pacific Mountains.

The State of Alabama is divided into three of the landform regions as shown on the illustration below. Thus, Alabama is described as "having it all," from the Gulf beaches to the mountains.

BEST COPY AVAILABLE

Materials

- ALABAMA OFFICIAL HIGHWAY MAP

Procedure

1. On an Alabama Official Highway Map, delineate the three landform regions.

2. Lead a class discussion of the topography of the three regions located generally and specifically within Alabama.

3. Discuss farming potential in areas of Alabama.

4. Discuss economic factors involved in road construction as it relates to topography and landforms.

GRADE 8
EARTH SCIENCE

UNIT: Earth
TOPIC: Lithosphere
OUTCOME: 97. Interpret geologic features as they appear on a topographic map.

Background

Elevations on a topographic map are indicated by contour lines.

Materials

- Handout, CONTOUR MAP PUZZLE
- Handout, KEY TO PUZZLE

Procedure

1. Divide students into groups. Give to each group the Handout, CONTOUR MAP PUZZLE.

2. Tell the following story. "This past weekend I marked off a square mile of land area. Within the mile square, I made 16 elevation measurements in feet above sea level. Please take this page that indicates where I made my measurements and draw contour lines to show the geologic terrain of this square mile."

3. Direct students to connect points that have the same approximate elevation within a range of 100 feet. (For example, connect all 200 foot range measurements, all 300 foot range measurements. No two lines should cross. See key to contour map.)

4. After students have drawn their contour lines, give each group a copy of the Handout, KEY TO PUZZLE, for comparison. The key provides a vertical view of the terrain.

5. Instruct students to make a line drawing that represents the terrain from a horizontal view. (The drawing should look somewhat like a bell curve.) (If the Handout, CONTOUR MAP PUZZLE, is turned side ways, a horizontal view should look somewhat like a bell curve.)

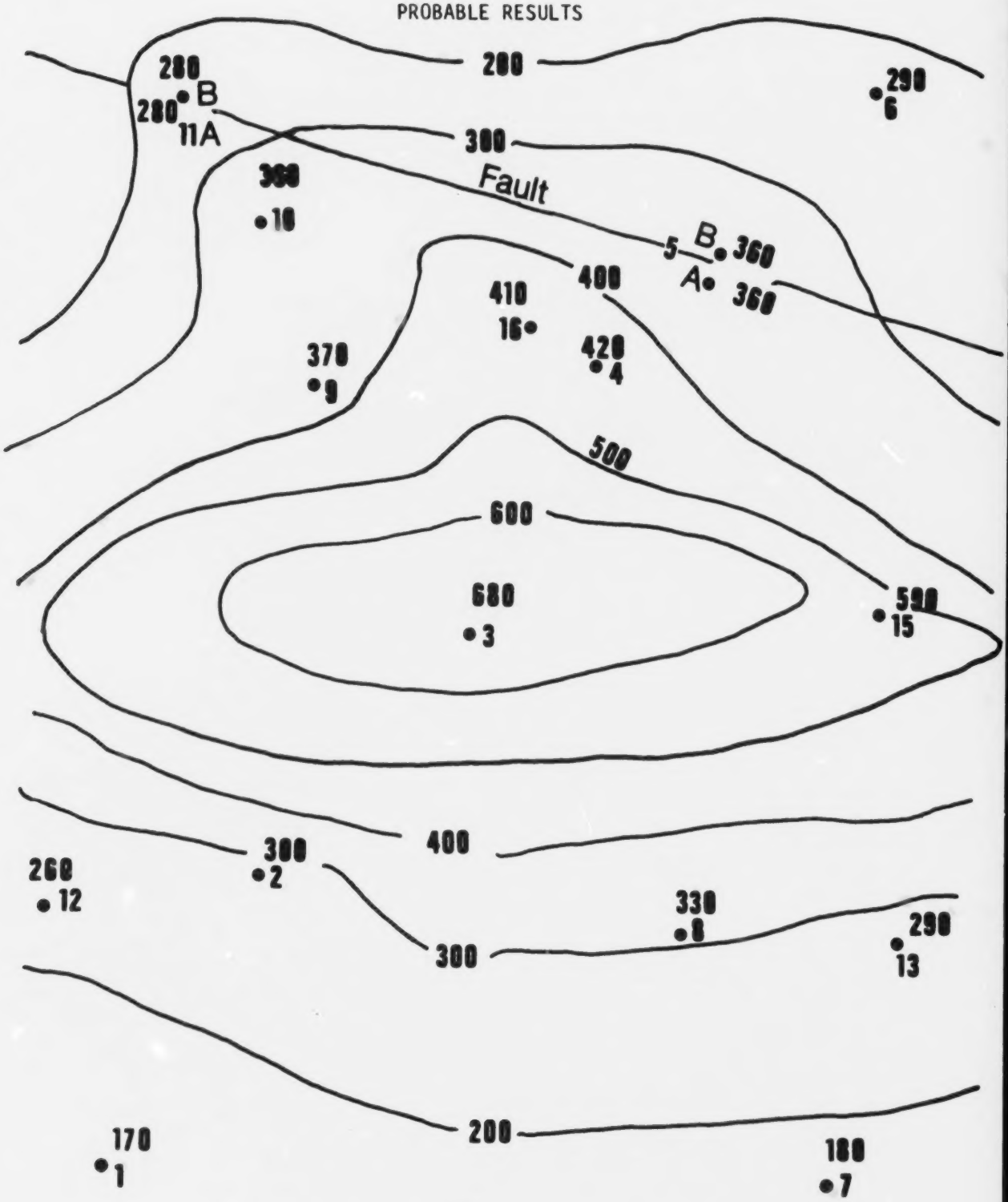
Example:

CONTOUR MAP PUZZLE
Handout

212

CONTOUR MAP PUZZLE
Key

PROBABLE RESULTS



GRADE 8
EARTH SCIENCE

UNIT: Earth
TOPIC: Lithosphere
OUTCOMES: 99. Define weathering.
100. Describe three major weathering processes.

Background

Weathering is described as the breaking down of rocks and other materials by processes utilizing water, temperature, and chemical reactions. There are three types of weathering: chemical, mechanical, and biological. This activity is designed to help students understand the process of chemical weathering.

The activity will take two class periods. Before beginning the activity, assemble the number of work stations needed to divide the class into groups of three or four.

Materials

- Limestone samples
- Steel wool (1 inch squares)
- Beakers (500 ml)
- 500 ml water
- 500 ml vinegar
- Paper towels
- Masking tape

Procedures

Day 1

1. Lead the class in a brief discussion of chemical weathering.

2. Divide the class into groups. Equip each group with five beakers, water, vinegar, steel wool, paper towels, and limestone samples.

3. Instruct each group to treat a piece of steel wool by immersing it in a beaker of vinegar. Remove the steel wool from the vinegar and place it on a paper towel. Repeat this procedure with another piece of steel wool.

4. Have students place one piece of the treated steel wool in an empty beaker and the other treated piece of steel wool in a beaker of water. Make sure that the steel wool is not completely covered with water.

5. Have students label these two beakers with a small piece of masking tape by putting their names on the tape.

6. Instruct students to set the used jar of vinegar aside.

7. Have students place one of the pieces of limestone in a beaker of water and observe and record any changes or activity in the water. (The water bubbles.)

8. Have students place the second piece of limestone in a beaker of vinegar and repeat the observation process. Ask students why limestone bubbled more when exposed to vinegar than when exposed to water.

9. Lead the class in a discussion of chemical reactions that break down rock. Point out to students that in the state of Florida, where there are large limestone deposits, the dissolving of limestone in the roof of a cave causes the roof to collapse, thus creating a sinkhole. The acids that break down this limestone come from water seeping through the ground and combining with various ground products and gases to form mild acids.

10. Direct students to clean the working area of all materials except the two beakers containing the steel wool.

Day 2 (24-48 hours later)

1. Have students compare the beakers containing the steel wool samples and determine which sample shows the most rust. Discuss causes of rust (oxidation reaction) and the chemical formula for rust. (Fe_3O_2 - iron oxide)

2. Lead the class in a discussion of other examples of oxidation reactions.

3. Instruct students to compile a list of observations that show evidence of chemical weathering. Lead the class in a discussion comparing the lists.

4. Discuss acid rain as an agent of chemical weathering.

GRADE 8
EARTH SCIENCE

UNIT: Earth
TOPIC: Lithosphere
OUTCOME: 100. Describe three major weathering processes.

Background

Wind, water, and ice contribute to the breaking down of rocks and other materials. This activity will enable students to visualize the mechanical weathering process of exfoliation, i.e., the breaking off of small or large pieces of a rock caused by repeated changes in temperature from hot to cold.

Before beginning the activity, assemble three work stations in the classroom. Equip each work station with a hot plate, metal pan of dry sand, pair of tongs, pot holder, beaker of ice water, paper towels, and one glass marble for each student assigned to the work station. Place the pans of sand on the hot plate and preheat the sand for approximately 20 minutes. Sand is used instead of boiling water in order to achieve a temperature above 212 degrees F. or 100 degrees C.

Materials

- Glass marbles
- Hot plates
- Metal pans filled with dry sand
- Tongs
- Pot holders
- Beakers or jars of ice water
- Paper towels
- Goggles for student use

Procedures

1. Instruct students to observe a marble and record their observations. Examples: clear, smooth, solid.

2. Using tongs and a pot holder, have each student bury a marble in the heated sand.

3. While allowing the marble to heat in the sand, ask students to predict the outcomes of this activity and hypothesize why sand is used instead of boiling water.

4. After approximately 15 minutes, direct students to secure the pans with pot holders, remove the marbles from the sand with tongs, and drop the marbles into the beaker of ice water for two minutes.

5. Have students remove and place on paper towels the marbles from the ice water. Warn students not to touch the marbles as they may be hot.

6. Direct students to observe any changes that have occurred in the marbles.

7. Explain to students that the changes observed in the marbles are examples of mechanical weathering and that internal shattering occurred as a result of the uneven stresses produced by heating and then rapidly cooling the marbles.

8. Discuss exfoliation with the students. Explain to students that when heated by the sun, rocks heat unevenly causing cracking and flaking to occur.

GRADE 8
EARTH SCIENCE

UNIT: Earth
TOPIC: Lithosphere
OUTCOME: 101. Discuss erosion.
102. Explain the role of gravity in moving earth material downhill.
103. Discuss landscape features shaped primarily by running water, glaciers, and wind.

Background

Erosion surfaces are land surfaces shaped and subdued by the action of erosion, especially that caused by running water. Examples of these land surfaces are deltas, alluvial fans, and oxbow lakes. Large amounts of sediment are transported to form these new land features. The Mississippi River transports 400 million tons of soil per year to the Mississippi Delta. This is enough sediment to cover 3,240 square miles of land with a layer of silt one inch in depth. Gravity plays a tremendous role in causing the sediment to settle outward as the flow of water slows.

Materials

- Pencil
- Typing paper
- Handout, WORKSHEET 1
- Clipboard of writing surface

1. Lead the class in a brief discussion of landforms which are created by running water.

2. Direct students to explore the school grounds starting at the outer perimeter and working inward or starting on one side and moving back and forth across the grounds.

3. Have students observe and draw a map of the school grounds. Instruct students to mark the directions north, south, east, and west on the map.

4. Instruct students to locate and draw on WORKSHEET 1 each example of erosion found on the school grounds, identify the landform, label the direction of the water flow, and place the number of the example in the corresponding location on their maps of the school grounds.

5. After all students have completed their observations, return to each example of erosion located by the students. Discuss the formation processes and type of each.

6. Compare the examples of erosion found on the school grounds with larger examples of erosion found in various locations such as the Mississippi River Basin or local river systems.

WORKSHEET 1

NAME: _____ CLASS PERIOD: _____

↑ NORTH ↑

1.

ALLUVIAL FAN

2.

3.

4.

5.

6.

7.

8.

9.

10.

11.

12.

GRADE 8
EARTH SCIENCE

UNIT: Earth
TOPIC: Hydrosphere
OUTCOMES: 104. Discuss major ocean currents.
105. Outline five major cells of ocean circulation.

Background

The winds on earth cause currents in the oceans. Ocean water is always moving and the currents occur in specific directions, usually flowing in a loop pattern. The currents flow clockwise in the Northern Hemisphere and counterclockwise in the Southern Hemisphere.

The prevailing winds as shown on page 204 determine the consistent ocean currents illustrated on page 205. These major cells of ocean currents parallel the patterns of the prevailing winds. The prevailing wind patterns are partially determined by warm air masses near the equator and cold air masses near the poles.

Materials

- Overhead projector
- Transparencies of PREVAILING WINDS and OCEAN CURRENTS
- Markers (red and blue)
- Lazy Susan
- Large bowl
- Water
- Food coloring (red and blue)

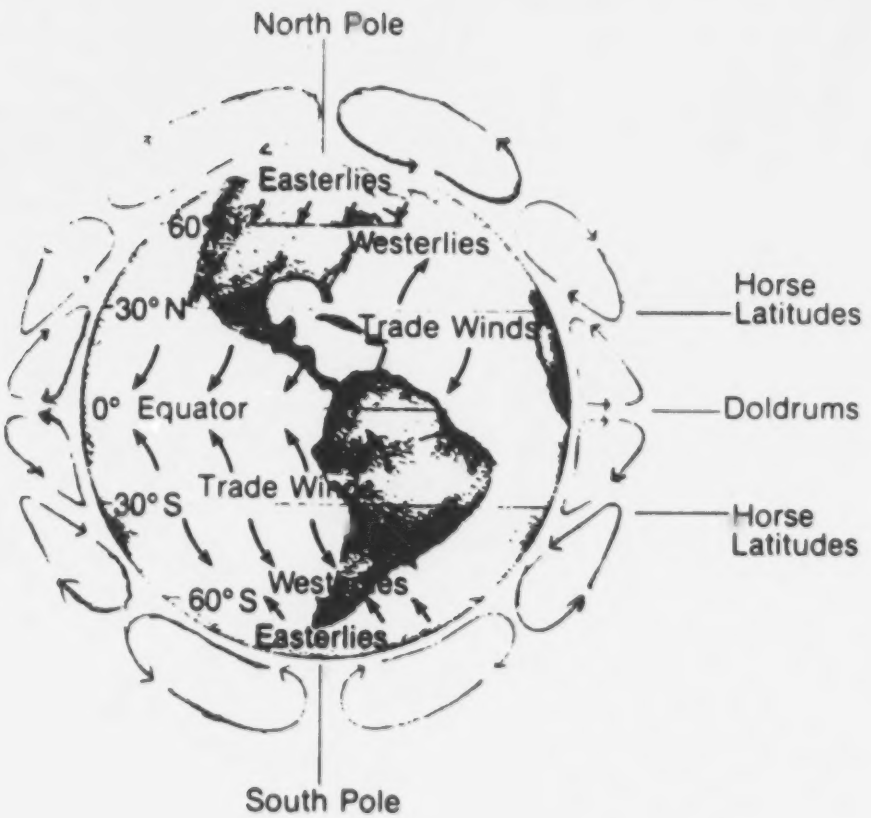
Procedures

1. Use the TRANSPARENCY OF PREVAILING WINDS and the TRANSPARENCY OF OCEAN CURRENTS to discuss currents and circulation of currents with students. During the discussion, use the red marker to identify warm winds and currents and the blue marker to identify cold winds and currents.

2. Place a large bowl of water on the Lazy Susan. Spin the Lazy Susan gently in a counterclockwise direction. Drop a small amount of red food coloring in the middle of the water. Allow students to observe the results. Let the water rest until it is settled.

3. Rotate the Lazy Susan in a clockwise direction. Drop a small amount of blue food coloring near the sides of the bowl of water. Allow students to observe the results. Have students relate their observations to winds and ocean currents.

TRANSPARENCY OF PREVAILING WINDS



TRANSPARENCY OF OCEAN CURRENTS

222

GRADE 8
EARTH SCIENCE

UNIT: Earth
TOPIC: Atmosphere
OUTCOMES: 106. Name four major gases of the atmosphere.
107. Explain how atmospheric pressure is measured.
108. Use a barometer.

Background

The atmosphere of the earth is composed primarily of nitrogen and oxygen. These two gases comprise almost 99% of the gases in the air. The remaining one percent consists of argon, carbon dioxide, and traces of many other elements.

The earth's atmosphere serves as a protective barrier, shielding the earth from all types of radiation and particles in outer space. This protective blanket of atmosphere exerts pressure on the surface of the earth. Atmospheric pressure fluctuates based primarily on the temperature of the atmosphere at a given area. When air is warm it tends to rise, reducing atmospheric pressure. At the same time, warm air tends to hold more moisture. Therefore, falling atmospheric pressure is one sign of potential rain. Do changes in atmospheric pressure affect our health directly? Just ask a person with inflamed joints due to arthritis!

Changes in atmospheric pressure are measured with a barometer. There are two types of barometers, mercurial and aneroid. A mercurial barometer consists of a column of mercury, calibrated to note variations. An aneroid barometer uses a spring and needle device attached to a closed container. Air pressure impacts upon the container causing the spring and needle assembly to register changes. This activity allows students to construct a simple aneroid barometer.

Materials

- Large-mouthed jar such as a mayonnaise jar
- Large balloon
- Airplane glue
- Matches, wooden
- Rubber bands
- Soda straw
- Cardboard
- Protractor

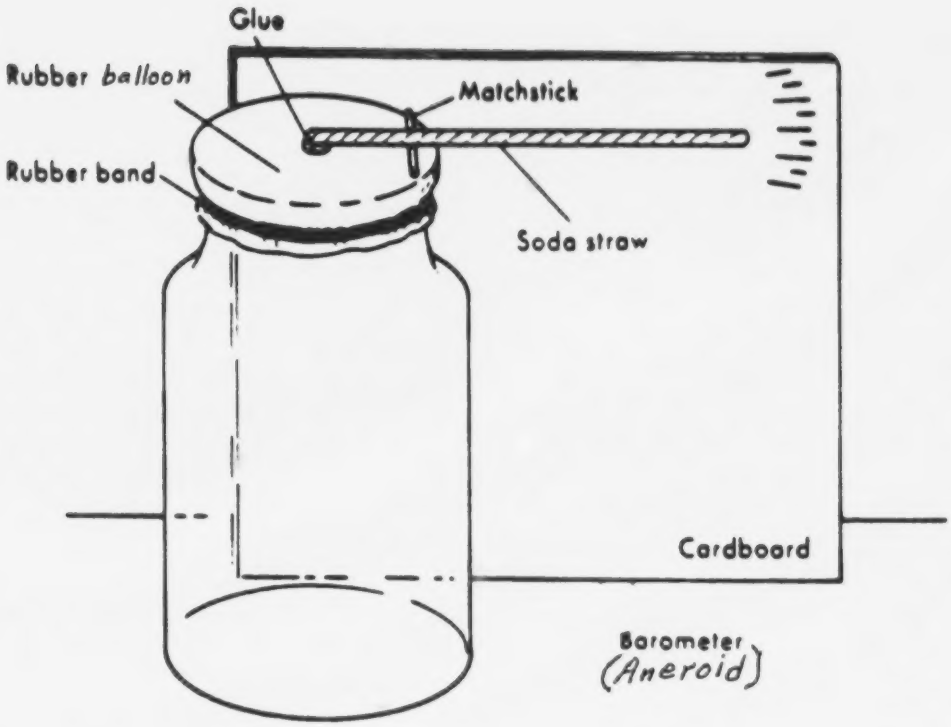
Procedures

1. Place the jar in hot water to eliminate some of the air in the jar. While the jar is still warm, stretch the balloon tightly over the mouth of the jar. Secure the balloon with a rubber band.

2. Glue one end of a soda straw to the middle of the balloon.

3. When the glue dries, place a match stem under the straw near the edge of the mouth of the jar. Using a protractor, mark off calibrations on a piece of cardboard and place the cardboard near the outer tip of the soda straw. (See illustration below)

4. Each day have students check the calibration marks against the soda straw tip. A falling tip indicates falling atmospheric pressure. A rising tip is caused by an increase in atmospheric pressure.



GRADE 8
EARTH SCIENCE

UNIT: Earth
TOPIC: Atmosphere
OUTCOME: 109. Explain what makes wind blow.

Background

This activity teaches students one of the reasons wind blows. Wind is a part of weather and is caused by uneven heating of the atmosphere by the sun. Because there is uneven heating of the surface of the earth, there is uneven heating of the atmosphere. This causes air to move in all directions and this movement is called wind. Air above hot surfaces expands and rises and cooler air moves in to take the place of the warm air. This is called circulation. General circulation occurring over large sections of the planet's surface produces prevailing winds. Wind is circulated by the rotation of the Earth.

The earth's rotation and varying elevations on the earth contribute to wind patterns. The general wind patterns move from the poles to the equator or from regions of cold temperature to regions of hot temperature. Since the earth is tilted on its axis and rotates, heating of the atmosphere and heating of the surface are not equal. Some areas receive more heat than others. Some areas retain the heat while other areas cool more rapidly.

Materials

- Cardboard box with top
- Aluminum foil
- Black construction paper
- Cardboard tubes (tissue paper rolls) (2)
- Masking tape
- Plastic wrap
- Tissue paper strips
- Lamp (75 watt bulb)
- Scissors

Procedures

1. Cut a "window" on the side of the box leaving a one-inch border.

2. Cut out a cardboard partition that is the same height as the box but is five centimeters shorter than the length of the box. Tape the piece of cardboard so that it separates the box into two sections. Leave a space between the "window" and the end of the partition.

3. Line one side of the box with aluminum foil and label it SIDE A. Line the other side of the box with black construction paper and label it SIDE B.

4. Cut one hole in the top of the box over SIDE A and cut one hole in the top of the box over SIDE B. Push a cardboard tube through each hole.

5. Cover the "window" with plastic wrap and tape it tightly to the box.

6. Place the lamp on the window side of the box. Turn on the lamp for five minutes.

7. Distribute a tissue paper strip to each student. Instruct the students to hold the tissue paper over the top of each tube and note what happens.

8. Discuss the following questions:

   a. Is air moving in the tubes?
   b. Which side of the box do you think is hotter? Why?

9. Relate movement of the air to causes of wind.

GRADE 8
EARTH SCIENCE

UNIT: Earth
TOPIC: Atmosphere
OUTCOME: 110. Describe convection current.

Background

The most efficient method of heating the atmosphere is by convection. Most of the heat in the atmosphere is transferred by convection currents that travel in gases and liquids and create a constant interchange between warm air and cold air. Heat transfer by fluid motion between regions of nonuniform heating results in what is called convection currents. The tropics receive the most heat from the sun while the poles receive little or none. The temperate zones between these two regions receive more heat than the poles but less than the tropics. Because of this distribution of heat, air is always in motion with the warm air rising at the equator and the cold air from the poles moving in to replace it. A circular movement or thermal cycle results.

Materials

- Aquarium with light and cover
- Ice

Procedures

1. Prior to class, place an aquarium on a desk and turn on the aquarium light so that the air inside the aquarium will be warm. Place a tray of ice on the bottom of the aquarium.

2. When class begins, crumple three sheets of paper together lengthwise and light them with a match. Blow out the flame and place the smoking paper inside the aquarium.

3. Turn off the classroom lights and instruct students to observe the circulation pattern of the smoke. Explain to students that this motion simulates the convection currents in the earth's atmosphere.

GRADE 8
EARTH SCIENCE

UNIT: Earth
TOPIC: Atmosphere
OUTCOME: 111. Demonstrate the convection cell.

Background

The troposphere is the lower part of the atmosphere where weather occurs. The higher a person goes into the troposphere, the cooler the temperature becomes. This layering of air, warm above cool, creates vertical mixing. On earth rising currents of warm moist air coming from the equator displaces cold air found at higher altitudes.

As the warm equatorial air rises and expands, it begins to cool. Equatorial air moves about one third of the way to the poles before it sinks again creating a mixing of tropical air known as the Hadley Cell. Another cell of circulating air at 30^{o} north and south latitude is created. This cell interacts with the Hadley Cell to define the general pattern of global weather circulation.

The direct cause of convection in the atmosphere is the unbalanced pressure resulting from the heating of cooler air. When air, water, or any other fluid is cooled, its density increases, and when it is warmed, its density decreases. The cooler air tends to sink as gravity has more effect on cooler air than on a warm air, less-dense body of air.

A convective current is created by cooler substances moving toward warmer substances. A convection cell occurs when convection makes a complete circuit. Convection takes place in the atmosphere, oceans, and interior of the earth.

Materials

- Handouts made from Transparencies of TRANSPARENCY OF PREVAILING WINDS and TRANSPARENCY OF OCEAN CURRENTS, OUTCOMES 104 and 105

Procedures

1. Lead the class in a discussion of what causes convection cells.

2. Divide the class into small groups. Instruct students to discuss the convection cells occurring in the atmosphere and in the oceans, utilizing the handouts from Outcomes 104 and 105.

3. Project the transparencies from Outcomes 104 and 105 and have students summarize their group discussions.

GRADE 8
EARTH SCIENCE

UNIT: Earth
TOPIC: Atmosphere
OUTCOME: 112. Draw a model of the global winds.
114. Describe large air movements for the whole earth.

Background

Wind belts are caused by major high and low pressure areas. Winds are caused by uneven heating of the air and follow a definite pattern across the surface of the earth. The earth's general wind patterns flow from the poles where the air is the coldest toward the equator where the air is the warmest.

There are three main surface wind belts in each hemisphere:

1. Trade winds - in the tropics - blow westward
2. Westerlies - in the middle latitudes - push eastward
3. Easterlies - near the poles - circle westward

The doldrums at the equator tend to be motionless wind areas consisting only of rising air.

Materials

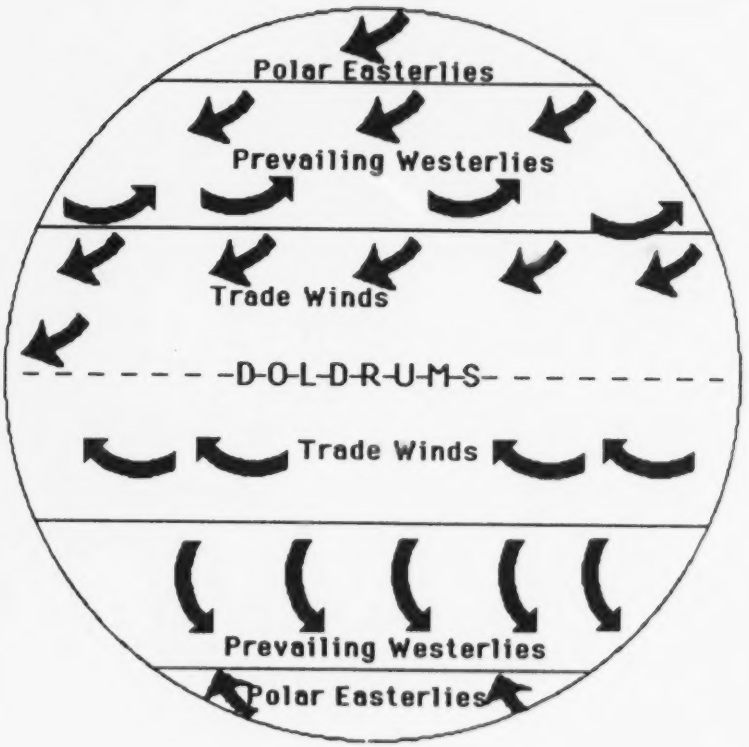
- Fine tip permanent markers
- Blue latex balloons
- Small paper clips
- Handout, GLOBAL WINDS

Procedures

1. Give students a copy of the Handout, GLOBAL WINDS. Discuss the handout with students. Explain to students the titles of the winds and the directions in which each flows.
2. Give each student a balloon, paper clip, and marker. Instruct students to partially inflate the balloon, pinch it closed, and secure it with the paper clip so that air does not escape.
3. Have students use the marker to draw lines indicating the various zones and arrows that indicate the wind direction as shown on the handout. Have students remove the paper clip and inflate the balloon more before retying it.
4. Ask students to name the various zones on their balloons and explain the direction of the winds in each zone.

GLOBAL WINDS
Handout

ZONE NUMBERS



4.
3.
2.
1.
2.
3.
4.

Definitions of Zones

1. DOLDRUMS --- Windless zone at the equator
2. TRADE WINDS --- Winds that blow toward the equator
3. WESTERLIES --- Winds that bring in weather across the United States
4. POLAR EASTERLIES --- Winds that energize the Westerlies

GRADE 8
EARTH SCIENCE

UNIT: Earth
TOPIC: Atmosphere
OUTCOME: 113. Explain the coriolis effect.

Background

The rotation of the earth creates the coriolis force. The coriolis force deflects air subjected to high and low pressure from a straight path to a curved path. The speed of the earth's rotation at the equator is 1600 km/hr while the speed drops to zero at the poles. This variation in speed of rotation causes air to be deflected. The coriolis force is not a real force, but is an illusion caused by rotation of the earth. This phenomenon causes both ocean currents and prevailing wind belts. This activity is a teacher demonstration which simulates the coriolis effect.

Materials

- Lazy Susan
- Plastic squeeze bottles (2)
- Red food coloring
- Blue food coloring
- Water
- Corn starch
- Spoon
- Quart bowl

Procedures

1. Prior to class, mix one cup of corn starch with enough water to produce the consistency of ketchup. Divide the mixture in half. Add red food coloring to one bottle and blue food coloring to the second bottle.

2. Tell students that the lazy Susan represents the earth and a view of the earth from space showing the earth rotating counterclockwise from above the North Pole.

3. Have students observe and spin the Lazy Susan in a counterclockwise direction. While this action progresses, squirt a steady flow of the blue mixture on top of the Lazy Susan starting at the center and rapidly moving in a straight line to the edge.

4. Using the bottle with the red mixture, spin the Lazy Susan clockwise as if seeing the earth from space above the South Pole. Squirt the mixture in a steady stream on top of the Lazy Susan. Discuss student observations.

5. Discuss student observations and direct students to complete the Handout, CORIOLIS FORCE.

GRADE 8
EARTH SCIENCE

UNIT: Earth
TOPIC: Meteorology
OUTCOME: 115. Define weather.

Background

This activity increases understanding of the elements that cause day-to-day changes in the atmosphere and are responsible for weather. The term "weather" refers to the current state of the atmosphere. This state changes frequently and includes changes in air pressure, precipitation, temperature, humidity, and wind direction. Changes in one or more of these areas are the result of development and/or motion of an air mass.

Weather moves generally from west to east in the Northern Hemisphere. Some kinds of weather conditions are more severe than others. Thunderstorms, tornados, hurricanes, and blizzards are examples of severe weather. Conditions in the atmosphere can become violent during these weather conditions. Unlike climate, however, these destructive atmospheric weather conditions are seasonal in nature.

Weather occurs in the troposphere or the area from the surface of the earth to a height of 16 kilometers.

Materials

- United States weather maps from newspapers
- Transparency of Figure 1
- Transparency pens
- Overhead projector
- Handout, ELEMENTS OF WEATHER
- Chalkboard

Procedures

1. On the chalkboard write definitions and give symbols for pressure, precipitation, temperature, humidity, and wind direction. Discuss the definitions with students.

2. Make a transparency of the outline of the United States (Figure 1). Draw common weather symbols on the bottom of the transparency.

3. Using the transparency and a recent weather map, draw weather symbols showing what types of weather were predicted for the various areas of the United States.

4. Ask students to explain what kinds of weather were predicted for various areas of the United States based on the weather map.

5. Have students discuss the accuracy of the predictions. Ask students to predict weather conditions for the next several days.

6. Direct students to complete the Handout, ELEMENTS OF WEATHER.

FIGURE #1

THE UNITED STATES

WEATHER SYMBOLS

217

ELEMENTS OF WEATHER
Handout

Directions: Match each term to a picture from a newspaper or magazine or draw a picture to illustrate the term.

FROST	FLOODING
RAIN	SNOW
HUMID	ARID
WINDY	CLOUDY
TORNADO	HURRICANE

GRADE 8
EARTH SCIENCE

UNIT: Earth
TOPIC: Meteorology
OUTCOMES: 115. Define weather.
116. Discuss how weather is predicted.
117. Illustrate how instruments are used for measuring weather.

Background

Weather is the day-to-day change that takes place in the atmosphere. Meteorology is the study of conditions of the atmosphere. A meteorologist is a scientist who specializes in the study of weather by gathering data from instruments such as a barometer, psychrometer, thermometer, anemometer, wind vane, and satellite.

Materials

- Local weather forecaster
- Weather maps from newspapers
- Handout, WEATHER MAP WORKSHEET
- Videotape of weather instruments
- Chalkboard

Procedures

1. Write on the chalkboard and discuss with students the following weather terms:

   a. Humidity (water vapor)
   b. Air pressure (highs and lows)
   c. Wind speed (miles per hour)
   d. Wind direction (North, South, East, West)
   e. Cloud formation (cloudy, partly cloudy)
   f. Air temperature (at sea level)
   g. Precipitation (rain, hail, sleet, snow)

2. Explain to students that a weather forecast is made by local meteorologists based on information received from state and national weather services. Use a videotape showing weather instruments to explain how information is collected and assessed. If possible, have a local weather forecaster visit the classroom and explain the procedures used.

3. Direct students to watch a television weather forecaster for five days and record information from the program on the Handout, WEATHER MAP WORKSHEET. Discuss the worksheet each day using weather maps from newspapers.

WEATHER MAP WORKSHEET
Handout

Indicate local temperature, pressure, wind direction, humidity, precipitation, and cloud cover each day

Which day was the prediction the most accurate?

DAY 1

DAY 2

DAY 1

DAY 2

DAY 3

DAY 3

DAY 4

DAY 4

DAY 5

DAY 5

GRADE 8
EARTH SCIENCE

UNIT: Earth
TOPIC: Atmosphere
OUTCOME: 117. Illustrate how instruments are used for measuring weather.
118. Differentiate between weather and climate.
119. Explain how location determines climate.

Background

Climate is described according to precipitation, temperature, or a combination of the two. An area that receives very little precipitation is described as having an arid climate while an area that receives abundant moisture is described as having a humid climate. Temperatures in various areas of the world vary with the latitude or location of an area in relation to the equator. In the tropics or areas close to the equator, the sun's rays that strike the earth are direct and cause temperatures of land and water to rise. Beyond the tropics in the middle latitudes lie the temperate zones where the sun's rays are more indirect and the climate is moderate. The North and South Poles are the areas farthest from the equator where the sun's rays are the most indirect. The sun's rays strike the poles at a high angle for only a portion of the year and result in land and water temperatures not rising as much as in other zones.

A third factor in determining climate is elevation of land areas above sea level. The higher the elevation or altitude of an area of land, the colder the temperature. Winds which blow inland over water also affect the temperature of land areas.

Materials

- Overhead projector
- Overhead transparency of Handout, CLIMATE ZONES
- Transparency pens
- Crayons
- Handout, CLIMATE ZONES

Procedures

1. Before beginning the activity, prepare a transparency of the Handout, CLIMATE ZONES. Review basic information about latitude and longitude with the students.

2. Give each student a copy of the Handout, CLIMATE ZONES. Using the overhead transparency, discuss climate and factors that affect climate.

3. During the discussion of climate zones have student volunteers color the various zones on the transparency as follows:

   Tropics - red
   Temperate - green
   Poles - blue

Have students color their handouts in the same colors.

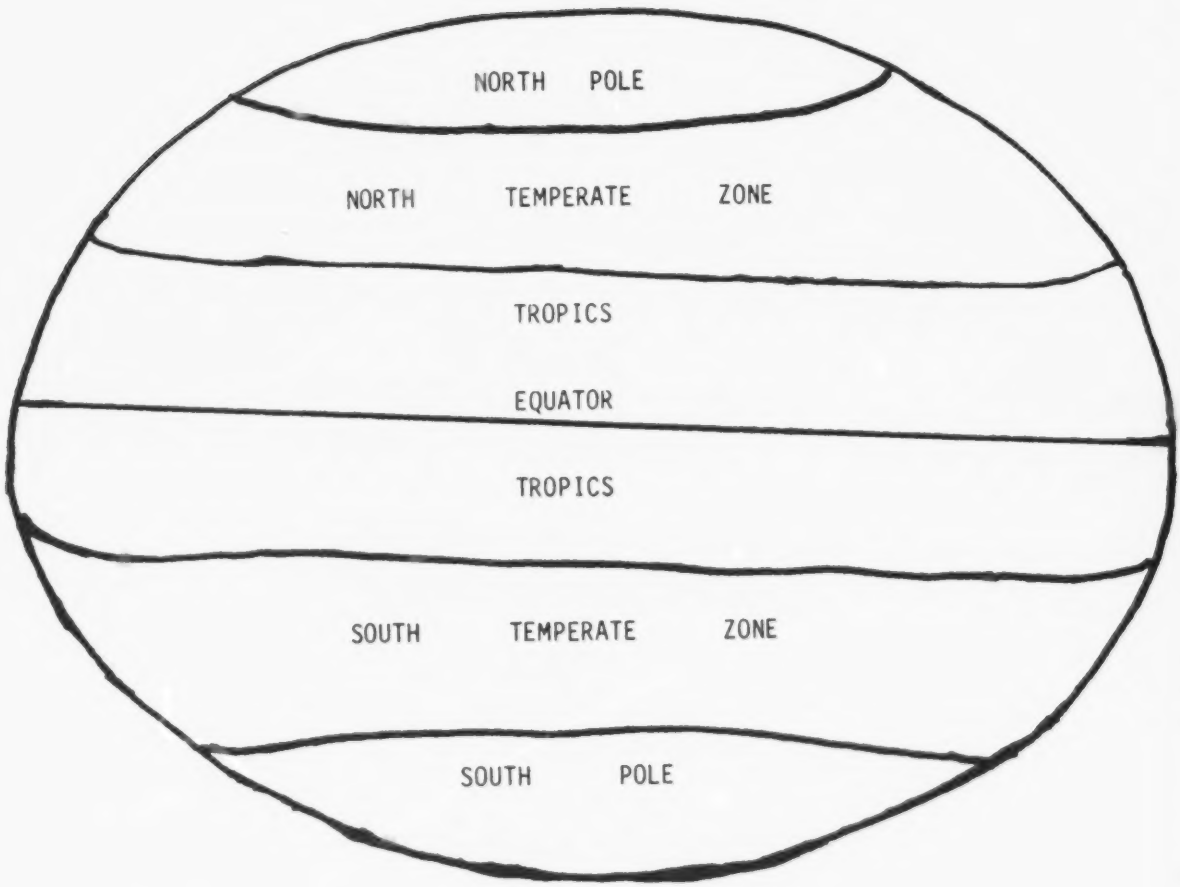
4. Group students into nine groups. Place the following names on slips of paper and ask each group to draw a name.

North America	South America	Africa
Asia	Australia	Europe
Antarctica	Arctica	Greenland

5. Have each group research the location and climate of their assigned area and explain the climate of the area to the class.

CLIMATE ZONES

Handout



GRADE 8
EARTH SCIENCE

UNIT: Earth
TOPIC: Atmosphere
OUTCOME: 120. Explain how solar energy determines global groups of climates.

Background

Climate is determined by the relationship between the earth and the sun. The regions of the earth near the equator receive more heat than those at the North and South Poles. Wind systems move heat from warmer regions to cooler regions. The heat that flows from warmer to cooler regions helps maintain an average earth temperature.

The areas of the earth that receive vertical rays of the sun are warmer than the areas that receive indirect rays. Land heats faster than water, but land also cools faster than water.

Polar regions receive indirect light rays from the sun. Therefore, land and water do not absorb as much heat as they do near the equator where the rays strike directly. The area near the equator is called the Tropics for this reason. The area north of the Tropics and also the area south of the Tropics receives rays from the sun that are less direct than those at the equator, but more direct than those at the poles. These regions are called Temperate Zones.

This activity may be conducted as either a teacher demonstration or as a student group activity. The activity has two parts.

Materials

- Flashlight
- Construction paper or tissue paper rolls
- Graph paper
- Black tape
- Small bowls
- Sand
- Water
- Lamp
- Meter stick or ruler
- Thermometer
- Protractor

Procedures

Part A.

1. Tape the tissue paper roll or a roll made from construction paper to the end of the flashlight.

2. Place the flashlight in a vertical position over the graph paper.

3. Draw a line on the graph paper around the area where the light is projected. Count the squares in the area.

4. Hold the flashlight at a 45-degree angle to the graph paper and repeat the procedure.

5. Tell students that the flashlight represents the sun and the graph paper the surface of the earth. Ask students to draw conclusions about the rays of the sun striking the earth. (The same amount of rays strike a smaller area at a vertical angle than at a 45-degree angle; therefore, the smaller area warms more.)

Part B.

1. Fill one container with sand and the other container with room temperature water.

2. Tape a thermometer to each container being certain that the bulb of each thermometer is covered by .5 cm of either sand or water. Record the temperature registered by each thermometer on a chart as shown below.

3. Place the lamp approximately 30 cm from the containers. After one minute, record the temperature in both containers on the chart.

4. Repeat the temperature recording after 5 minutes and 10 minutes.

5. Turn off the lamp and record the temperatures in the containers after 1 minute, 5 minutes, and 10 minutes.

6. Discuss the outcomes of the experiments with students. Ask students to draw conclusions about the speed at which water and soil heats and cools.

TEMPERATURES WITH SUNLIGHT

	Beginning	1 min.	5 min.	10 min.
SAND				
WATER				

TEMPERATURES WITHOUT SUNLIGHT

	Beginning	1 min.	5 min.	10 min.
SAND				
WATER				

GRADE 8
EARTH SCIENCE

UNIT: Earth
TOPIC: Atmosphere
OUTCOME: 121. Explain major groups of climates based on temperatures.

Background

This activity should follow a lesson on latitude, altitude, and climate. The earth is divided into five major climate zones. The tropics are areas north and south of the equator (0^{o}) latitude. Temperatures change very little from one month to the next and the sun's rays usually strike the earth at nearly a 90^{o} angle.

Near the North and South Poles are the frigid areas, or the polar regions. When the South Pole is tilted toward the sun, the Southern Hemisphere has summer and the South Pole has 24 hours of daylight.

Between the tropics and the poles are the temperate zones. Weather changes for the most part with the seasons. Summers are hot and winters are cold. Spring and fall have mild temperatures.

In general, the lower the latitude, the higher the average yearly temperature and the higher the latitude, the lower the average yearly temperature. Climate zones are based on latitude. Even though two areas are at the same latitude near the equator, one area may be colder because of its higher altitude.

Materials

- Handout, MAP OF THE WORLD (page 241)
- Reference books or encyclopedias
- Almanac
- Chalkboard

Procedures

1. Copy the page in this activity titled TABLES on the chalkboard. Instruct students to copy and complete the tables using reference books.

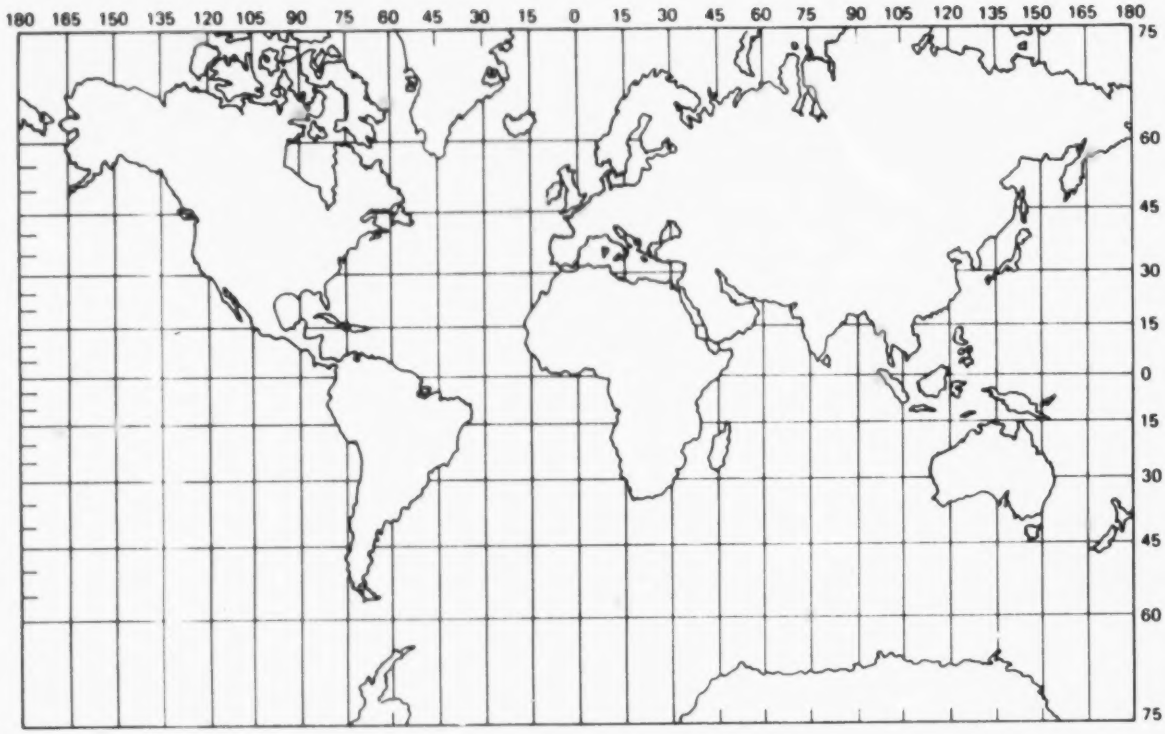
2. Explain to students how to determine temperature range. (By subtracting the low temperature from the high temperature).

3. Distribute to each student a Handout, MAP OF THE WORLD. Instruct students to use the reference books or almanac to identify pertinent information on climate.

4. Discuss the climate variations in the world and in the United States. Point out the significance of latitude and altitude on the temperatures of an area.

MAP OF THE WORLD
Handout

Directions: Label the continents, the equator, and the five climatic regions of the world.



TABLES

Using an almanac, encyclopedia, or reference book, identify the following information.

CITY AND STATE	Altitude	Latitude	Highest Temp.	Low Temp.	Range
Concord, NH					
Kansas City, MO					
Mobile, AL					
Miami, FL					
Detroit, MI					
Charleston, SC					
Denver, CO					
San Francisco, CA					

	Altitude	Latitude	Highest Temp.	Low Temp.	Range
Greenland					
South America					
North America					
Antaractica					
Australia					
Africa					
Asia					

What conclusions have you drawn from this research? (See background for answers.)

GRADE 8
EARTH SCIENCE

UNIT: Earth
TOPIC: Natural Resources
OUTCOMES: 122. Discuss natural resources.
123. Identify some renewable resources.
124. Explain uses of minerals and ores.
125. Define nonrenewable resources.

Background

Natural resources are materials that man has determined to be useful. Industrial materials, mineral deposits, and waterpower supplied by nature all constitute natural resources. This planet is composed of a wealth of resources that modern mankind uses in improving the quality of life. Resources considered to be renewable include such supplies as animal or vegetable foods renewed each growing season.

One class of nonrenewable resources are metal ores derived in their natural state from the earth. This activity isolates the metal ore, iron, and emphasizes steel production from iron ore. This insight into steel production factors and needs, coupled with man's dependence on steel, causes students to appreciate the demands made on the earth's natural resources.

Material

- Handout, DATA SHEET ON STEEL PRODUCTION

Procedures

1. Divide students into groups. Provide each group with copies of the Handout, DATA SHEET ON STEEL PRODUCTION.

2. Tell students to read and discuss the data pertaining to steel production. At the end of the discussion, instruct each student to write one or two paragraphs summarizing their impressions of how the steel industry depends upon metal ore resources. A comment related to conservation of natural resources would also be appropriate. Provide a time for student impressions to be presented to the other students in the classroom.

DATA SHEET ON STEEL PRODUCTION
Handout

The basic element required in the production of steel is iron ore. Use by mankind of iron ore is the reason it is often said that modern man lives in the "Iron Age." Steel is used in the production of many products we buy and use including autos, stoves, refrigerators, and lawn mowers. Our homes and schools contain steel for better support and safety. When steel is made from iron ore, nonrenewable resources of the earth are being consumed. The material below gives information on requirements for making steel.

PRODUCTION AND DEMAND FOR IRON AND STEEL
1965, 1975, and estimated 1985 and 2000

Raw or Crude Steel Production in millions of tons. (Raw or crude steel is produced from iron ore and scrap iron. About 30% of raw steel becomes scrap before reaching the finished product stage. 1.43 tons of raw steel yield about 1 ton of finished steel.)

	1965	1975	1985	2000
U.S.	134.1	116.6	190	260
World	523.6	712.6	940	1,410

BACKGROUND INFORMATION: Basic operations essential to the final production of steel in finished form can be divided into the following categories:

A. Geological exploration and the determination of reserves and resources

B. Establishment of mine and concentrating plant

C. Transportation of usable ore

D. Manufacture of pig iron

E. Manufacture of steel

STEPS:

1. Events from the first indication that geological conditions in an area may be favorable; to the existence of ore deposits; to the final determination of reserves; may require a time period as long as 20 years or more.

2. Setting up a large iron mine is an expensive operation costing tens to hundreds of millions of dollars. This investment cannot be completed unless the mining company has assurance that reserves are ample to cover costs and yield a reasonable profit. Development of a mine and construction of a plant may require 3 to 7 years.

NOTE: Environmental costs - In 1976, open pit mines (strip mines) accounted for 95% of the total output of iron ore in the United States. Environmental concerns involve the effect of mining on the land, large amounts of waste rock, and pollution of waters. Public concerns over need for minerals and desire to preserve the environment often conflict.

3. Transportation from the mine to the steel mill is complex and costly, particularly when the sources of ore are in relatively inaccessible places such as the interior of Brazil or Australia. Often special railroads must be constructed. Barges and ships also are important carriers of iron ore.

4. Pig iron is produced in blast furnaces, where ore, coke, limestone, and other materials in smaller volume are subjected to a blast of air often enriched by oxygen or combustible gas at high pressures and temperatures. Coke is a source of energy and acts as a reductant, removing the oxygen from the iron ore. Products of the blast furnace are slag, molten iron, and low-grade gas used in the plant as fuel. The iron may be cast in pigs or fed in molten state into convertors which change it to steel.

5. Steel is produced from pig iron or hot metal from the blast furnace by a number of different processes. Raw steel is further processed to produce the goods required by society. Steel plants vary enormously in size and cost as much as hundreds of millions of dollars. There are numerous reasons for the higher cost of U.S. steel including higher labor costs, higher energy costs, use of low grade ores, and obsolescent technology.

MATERIALS USED IN PRODUCING STEEL
Other than iron ore and scrap

A. Materials used to produce 1 ton of steel (amounts vary depending on process used)

water - 60 to 250 tons
limestone - 1/3 ton (removes SiO from ore and makes slag)
fluorspar - 3 pounds (makes slag more fluid)
manganese - 15 pounds (scavenger: removes sulfur, oxygen, phosphorus, and other impurities)
coke - 600 pounds (removes oxygen, supplies heat, supplies carbon)
energy - 1.132 to 1.471 tons coal equivalent or about 33 million Btu's (av. bituminous coal 23,750,000 Btu per short ton)

B. Materials in basic steel, an alloy of iron with an average of about 1.5% carbon

element	major ores	
iron	magnetite Fe_3O_4 (72.4% Fe)	
	hematite Fe_2O_3 (70% Fe)	
	geothite Fe_2O_3-H_2O (60% Fe)	Commonly known as limonite

carbon	coke derived from coal	carbon gives steel greater strength and hardness than pure iron, makes it malleable and ductile

C. Some of principal alloying elements for special steels

element	major ores	function in steel
chromium	chromite	stainless steel, hardenability, high temperature strength
cobalt	by-product of many minerals	strong permanent magnets, high temperature hardness
aluminum	complex mixture of aluminous minerals called bauxite	deoxidation, grain-size control
manganese	pyrolusite psilomelane cryptomelane todorokite nsutite	resistance to shock and abrasion, deoxidation, sulfur control, hardenability, toughness, durability
molybdenum	molybdenite ferrimolybdite	strength at high temperatures, corrosion resistant
nickel	pentlandite garnierite	stainless steel, high temperature alloys, electric resistance alloys, low temperature toughness
niobium (columbium)	columbite	prevention of internal corrosion (canneries), stabilizer to prevent fatigue in such things as springs and bridges
tantalum	tantalite	high melting point, resistance to corrosion, toughness, durability
titanium	ilmenite rutile	acid resisting (hardware for salt water boats)
tungsten	scheelite wolframite by-product of other mining	hard carbide and hardened tool steel (drilling bits), high temperature hardness
vanadium	mostly by-product of other mining and oil refining	high tensile strength, tool steels, armorplate, cutlery, structural steels grain size control

zirconium	zircon baddeleyite	similar to manganese use

IMPORTS OF ESSENTIAL ELEMENTS FOR THE U.S. STEEL INDUSTRY

A. Major foreign sources of essential mineral commodities

Commodity	Source where mined
iron	Canada, Venezuela, Brazil, Peru, Chile, Sweden, Liberia, Australia
aluminum	Jamaica, Australia, Guyana, Surinam, Guinea
chromium	U.S.S.R., Rhodesia, South Africa, Philippines, Turkey
cobalt	Zaire, Zambia, Finland
manganese	Brazil, Gaon, Australia, Zaire, South Africa
nickel	Canada
niobium	Brazil, Canada
tantalum	Brazil, Canada
titanium- rutile ilmenite	 Australia, Sierra Leone (Sierra Leone mine closed 1971) Canada, Australia
tungsten	Canada, Australia, Bolivia, Peru, Portugal, S. Korea
vanadium	South Africa, Chile, U.S.S.R.
zirconium	Australia

PERCENT OF ELEMENTS IN EARTH'S CRUST

iron	5	niobium	.002
aluminum	8.13	tantalum	.0002
chromium	.02	titanium	.63
cobalt	.002	tungsten	.005
manganese	.1	vanadium	.01 - .015
molybdenum	.0001	zirconium	.026
nickel	.02		

GRADE 8
EARTH SCIENCE

UNIT: Earth
TOPIC: Global Location
OUTCOME: 126. Demonstrate longitude and latitude on a map.

Background

The exact position of any place on earth can be described utilizing degrees of longitude and latitude. Longitude designates locations as to east or west. Latitude expresses locations in degrees from north to south. A position south of the equator is designated in number of degrees S. A position east of Greenwich, England, the prime meridian, is designated by number of degrees E.

Students understand longitude and latitude better when they learn to pinpoint familiar places. This activity utilizes the Official Alabama Highway Map to answer questions of longitude and latitude. Obtain sufficient maps for students to work in small groups.

Materials

- Official Alabama Highway Maps
- Rulers, 12-inch
- Handout, MAP QUESTIONS

Procedure

1. Divide students into groups.

2. Discuss with students the longitude and latitude designations in the margins of the map. Tell students that the middle of Alabama is roughly 33^{o} N latitude and 86^{o} W longitude. Explain to students that each degree is further divided into 60 minutes; thus, a designation like 86^{o} 30' W longitude more accurately pinpoints longitude of the middle of Alabama.

3. After students generally become familiar with the map and longitude and latitude symbols in the margins, direct them to answer all questions on the Handout, MAP QUESTIONS. Rulers will aid students in the process.

MAP QUESTIONS
Handout

Using the map of the State of Alabama, estimate answers to the following questions.

QUESTION	ANSWER
1. What is the location of the state capitol?	_____
2. What is the location of the University of Alabama at Tuscaloosa?	_____
3. What is the location of Auburn University?	_____
4. What is the location of <u>your</u> school?	_____
5. You are all "wet." Your location is 30° 30' N latitude and 88° 00' W longitude. Where are you?	_____
6. You are at Lake Guntersville State Park. What is your location in degrees and minutes?	_____
7. Notice the mileage scale on the map. How many miles is it between degrees?	_____
8. How many miles do you live above the equator?	_____
Below the North Pole?	_____
9. How many miles do you live west of the prime meridian that runs north and south through Greenwich, England?	_____
10. How tall is Alabama in degrees of latitude?	_____
How wide is Alabama at the widest point in degrees of longitude?	_____
11. You live one minute of longitude west of your school. How many miles would you have to walk to school?	_____

KEY TO MAP QUESTIONS

1. 32 degrees 20 minutes N latitude, 86 degrees 15 minutes W longitude. (approximately)

2. 33 degrees 10 minutes N latitude, 87 degrees 20 minutes W longitude.

3. 32 degrees 40 minutes N latitude, 85 degrees 30 minutes W longitude.

4. Answers will vary with school location.

5. Middle of Mobile Bay.

6. 34 degrees 20 minutes N latitude, 86 degrees 00 minutes W longitude (approximately)

7. 60 miles (approximately)

8. Multiply 60 miles x number of degrees of N latitude (your location) = number of miles above the equator.

   Subtract number of degrees N latitude (your location) from 90 degrees 00 minutes (North Pole). Multiply number of degrees by 60 miles = number of miles below the North Pole.

9. Same calculation as in #8.

10. 4 degrees 45 minutes tall. (approximately)

    3 degrees 15 minutes wide (approximately)

11. One mile

GRADE 8
EARTH SCIENCE

UNIT: Earth
TOPIC: Global Location
OUTCOME: 127. Demonstrate how time zones are determined.

Background

The world is divided into 24 time zones. Each zone covers 15^{o} of longitude from the North Pole to the South Pole. The continental United States lies in four of these time zones. These four time zones are named for the parts of the country they cover. The Pacific Time Zone includes the states on the Pacific Coast and Mountain Time Zone includes the western states. The Central Time Zone includes most of the states east of the Rocky Mountains and Eastern Time Zone includes the states along the Atlantic Coast.

The time in each zone is one hour later than the zone to the west of it or one hour earlier than the zone to the east of it. The International Date Line is part of the World's Standard Time System. The International Date Line is a hypothetical line along the 180th meridian where each calendar day begins. Its location is about the middle of the Pacific Ocean. On the opposite side of the globe is the Prime Meridian (0^{o} longitude) which runs through Greenwich, England.

Materials

- Overhead projector
- Globe or map of the world
- Transparency of United States
- Crayons or magic markers
- Transparency pens (orange, blue, red, green)
- Handout, UNITED STATES MAP
- Handout, WORLD MAP
- Chalkboard

Procedures

1. Write these terms on the chalkboard: Central Time Zone, Eastern Time Zone, Pacific Time Zone, Mountain Time Zone, International Date Line.

2. Distribute the Handout, UNITED STATES MAP. Have students locate Alabama. Ask students to name the time zone for Alabama. (Central Time Zone)

3. Instruct students to color the state of Alabama blue.

4. Ask students to designate other states located in the Central Time Zone. Tell students to color the other Central Time Zone states blue. Point out to students that none of the boundaries of the time zones are straight lines.

5. Instruct students to mark the Pacific Time Zone and color the states of the Pacific Time Zone red.

6. Instruct students to locate the Mountain Time Zone and color the states of the Mountain Time Zone orange.

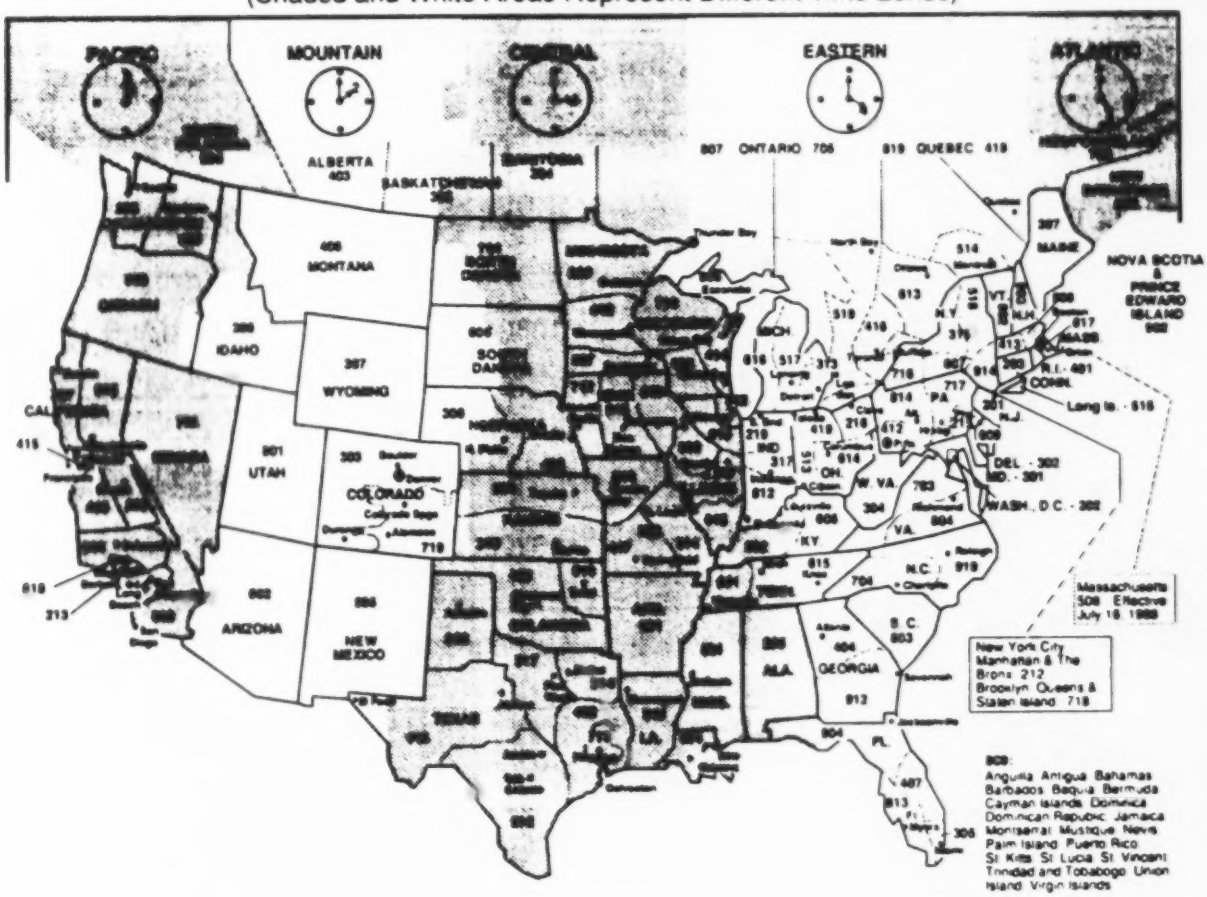
7. Instruct students to locate the Eastern Time Zone and color the states of the Eastern Time Zone green.

8. Distribute the Handout, WORLD MAP. Discuss world-wide variations in time.

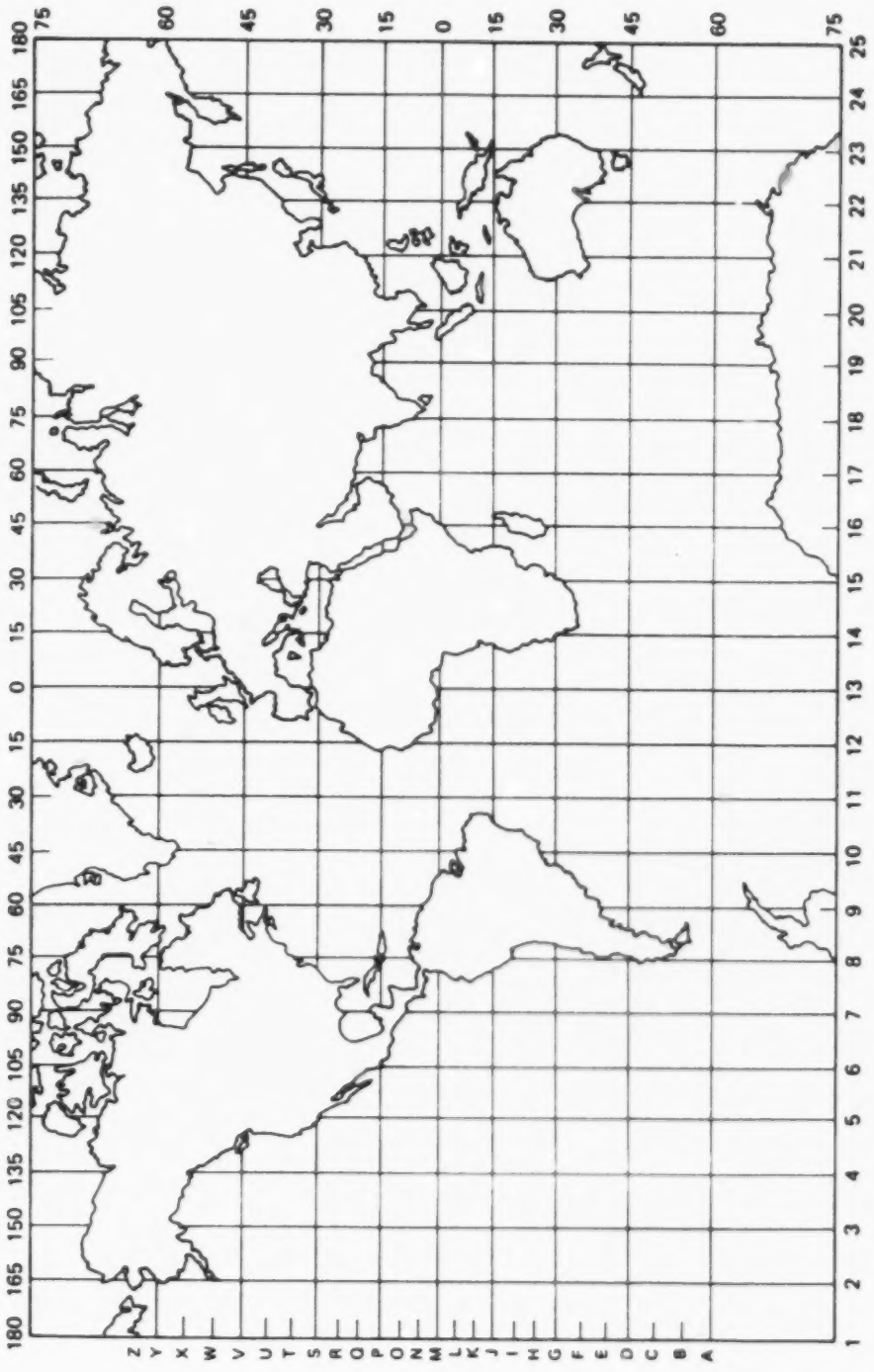
9. Lead a discussion on the value of having a consistent method for determining time anywhere in the world.

UNITED STATES MAP
Handout

(Shaded and White Areas Represent Different Time Zones)



WORLD MAP
Handout



GRADE 8
EARTH SCIENCE

UNIT: Current Trends in Earth and Space
TOPIC: Concerns for Life
OUTCOMES: 128. Describe various kinds of pollution.
129. Discuss prevention of pollution.
130. Research changes that have occurred in the environment.

Background

Pollution has become a major problem in our society today. One of the major kinds of pollution is the problem of trash produced by an exploding population and constant "improvements" in marketing and packaging products. This activity makes students aware of the massive amounts of refuse which are generated by a small group of people in one single day. Before beginning this activity, secure several menus from local fast food restaurants for all meals (breakfast, lunch, and dinner). If possible, obtain several examples of packaging materials from these fast food establishments. Ask the principal or assistant principal for a count of students and teachers in your school.

Materials

- Menus from several fast food restaurants
- Containers for packaging fast food items
- Handout, TRASH HEAP TALLY

Procedures

1. Lead the class in a discussion concerning the amount of trash generated by people patronizing fast food restaurants.

2. Instruct students to complete the Handout, TRASH HEAP TALLY, for the meals for one day from fast food restaurant menus.

3. Direct students to list and tally the trash items per meal. (Paper, plastic foam cups, straws, napkins, forks, salt.)

4. Have students list and tally any trash items from snack items they may consume in one day. (Candy, crackers.)

5. Direct students to total the number of trash items for one complete day.

6. Instruct students to multiply the total number of trash items for one day by the number of students in the class. Instruct students to multiply the one-day total by the number of students and teachers in the entire school.

7. Have students multiply each of their totals (person/day; class/day; school/day) by 7, and then by 365 to find the total number of items

generated by one person, one class, and one school in one week and one year.

8. Discuss the problems created by the trash generated by a small group of people and how it compares with that generated by the entire world.

9. Discuss possible solutions to reduce the large number of trash items, i.e., new kinds of packaging and possibility of problems with recycling.

Variations

1. Incorporate the populations of the city, county, state, or nation.

2. Weigh the packing items and calculate the average weight of the trash produced.

3. Discuss other trash items, such as large plastic trash bags and paper bags from the grocery.

4. Point out other problems created by some trash items that are not biodegradable, or which are very slow to decay.

5. Compare amounts of garbage generated from the same meal at different restaurants.

6. Have students list types of pollution. Choose one type of pollution and propose solutions for it.

TRASH HEAP TALLY
Handout

Name: _____

Breakfast: Restaurant: _____ Description

_____ = trash items	_____	( )
_____	_____	( )
_____	_____	( )
_____	_____	( )
_____	_____	( )
_____ (other items: forks,	_____	( )
_____ napkins, sauces, etc.)	_____	Subtotal

Lunch: Restaurant: _____ Description

_____ = trash items	_____	( )
_____	_____	( )
_____	_____	( )
_____	_____	( )
_____	_____	( )
_____ (other items: forks,	_____	( )
_____ napkins, sauces, etc.)	_____	Subtotal

Dinner: Restaurant: _____ Description

_____ = trash items	_____	( )
_____	_____	( )
_____	_____	( )
_____	_____	( )
_____	_____	( )
_____ (other items: forks,	_____	( )
_____ napkins, sauces, etc.)	_____	Subtotal

Snack Items

_____	_____	( )
_____	_____	( )
_____	_____	( )
_____	_____	( )
	_____	Subtotal

Breakfast subtotal + Lunch subtotal
+ Dinner subtotal + Snack subtotal = _____ Grand Total

TRASH HEAP TALLY
Handout
(Continued)

_____ Grand Total x 7 = # of items per person per week _____

_____ Grand Total x 365 = # of items per person per week _____

Grand Total x # of students in class = # of items per class per day. _____ x _____ = _____.

Grand Total x # of students in class x 7 = # of items per class per week. _____ x _____ x 7 = _____.

Grand Total x # of students in class x 365 = # of items per class per year. _____ x _____ x 365 = _____.

Grand Total x # of students in the school = # of items per day per school. _____ x _____ = _____.

Grand Total x # of students in the school x 7 = # of items per week per school. _____ x _____ x 7 = _____.

Grand Total x # of students in the school x 365 = # of items per year per school. _____ x _____ x 365 = _____.

GRADE 8
EARTH SCIENCE

UNIT: Current Trends in Earth and Space Science
TOPIC: Nuclear Energy
OUTCOMES: 131. Discuss role of nuclear energy in today's world.
132. Research changes that have occurred as a result of nuclear energy.
133. Demonstrate use of nuclear energy.

Background

Nuclear energy today is inherent in the use of electricity. Nuclear medicine alters treatment procedures for many illnesses. Nuclear weapons have enabled the United States of America to maintain a position of dominance in efforts to live in a peaceful world.

Nuclear power plants are complex because of safeguards needed to control the rate of nuclear fission, but the basic purpose is quite simple. Nuclear fission produces heat to make steam which turns turbines to generate electricity, just as coal is burned to generate electricity or as falling water at a hydroelectric dam site generates electricity. This is all based upon man's ever-increasing demand for energy in the form of electricity.

Materials

None

Procedure

1. Present and discuss the following information with the class.

   A factor that affects the price of electricity is heavy consumer use that results in "peak loads" on a generating station during relatively short periods of time. Home use tends to be heavy in the morning, late afternoon, and early evenings. Little electricity is used between 11:00 p.m. and 6:00 a.m. in most homes.

   Many factories operate only one or two shifts per day. Typically, retail stores make heavy use of electricity only during daylight and early evening hours.

   Weather also affects electrical use. Heavy air conditioner use on hot summer afternoons results in very large demands for electrical power.

   Since large amounts of electricity cannot be stored, an electric power station must have available a much higher generating capacity than is usually required. Some units, generally the most inefficient, may be operated as little as 20 percent of the time. Since idle equipment is expensive, the reserve or unused capacity adds significantly to the cost of electricity.

Instruct students to read their home electric meters according to a definite pattern over a 24 to 48 hour period of time. A suggested pattern might be 6:00, 8:00, and 10:00 a.m. - 12:00 noon - 2:00, 4:00, 6:00, 8:00, and 10:00 p.m.

Instruct students to calculate how many kilowatts of electricity are used during each two-hour block of time? Is the pattern of use consistent for each student's family? If not, can the discrepancies be explained?

Engage the class in discussing the merits of time-of-day pricing. Such an arrangement (possible through special meters) would result in electricity costing more during periods of very heavy demand and less during periods of light demand such as from 10:00 p.m. to 6:00 a.m. How many families would (or could) change their pattern of using electricity to take advantage of such an arrangement?

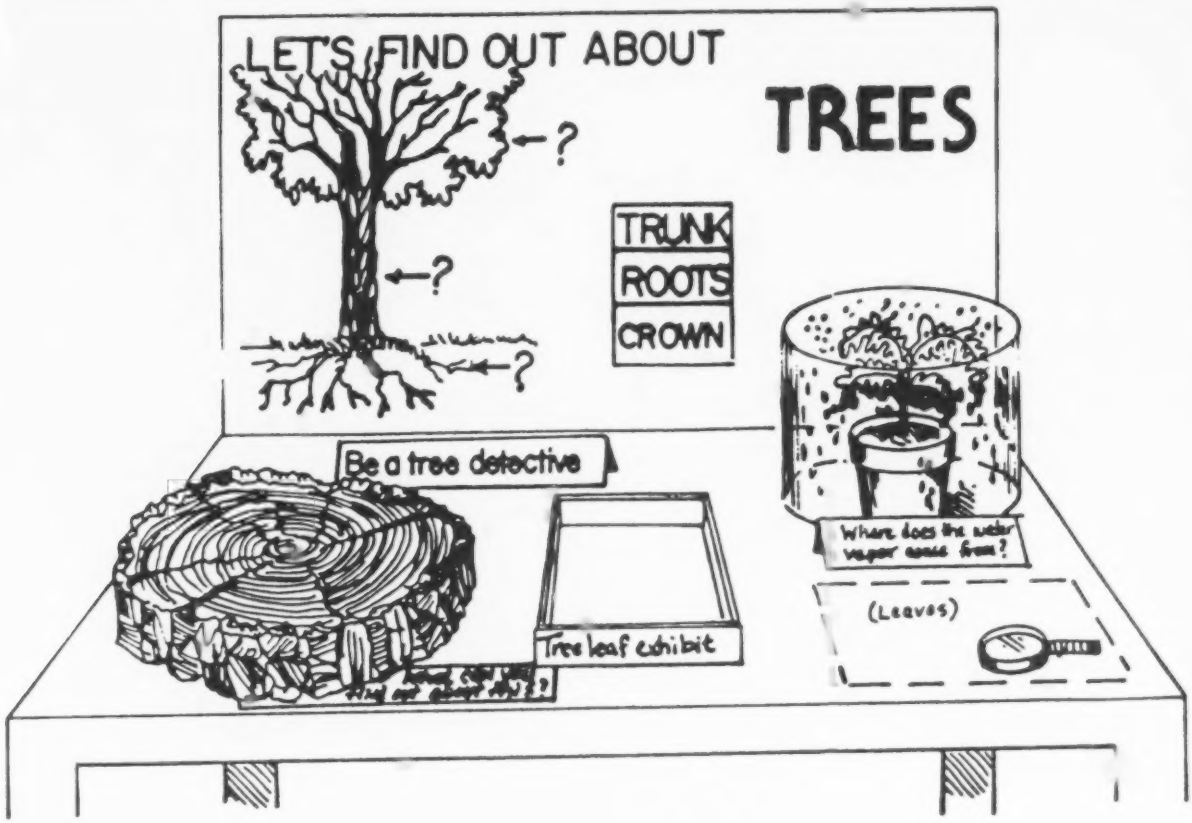
APPENDIX A
CLASSROOM ENVIRONMENT

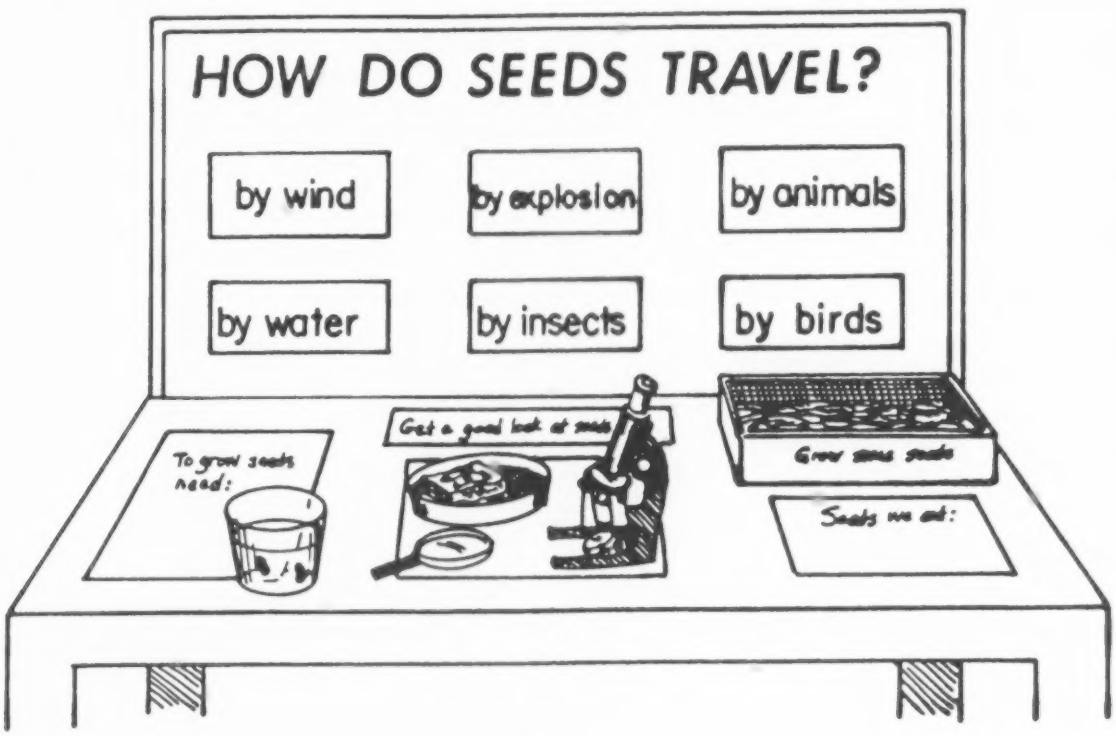
CLASSROOM ENVIRONMENT

The classroom environment is extremely important to the teaching/learning process. The appearance of the room should say that science is being taught here. It should express to the students "We are here to learn." The bulletin board is one way that reveals the science environment of the classroom. The bulletin board, therefore, is a tool--a tool of communication. It can communicate to the students the general task to be accomplished--that science is taught and learned in this classroom. To leave personal interests and problems of the moment outside the classroom door and to "change channels" of thinking quickly may be difficult for students. To assist in this change and to make maximum use of instructional time, the bulletin board can focus the students' attention on the subject at hand. The bulletin board can communicate the subject being studied.

The bulletin board should communicate effectively only one basic idea at a time. To zero in on that one thought, a specific theme is needed. The theme may be descriptive, provocative, or imaginative, but it must capture and stimulate interest. Well-designed science bulletin boards present changes, illustrate concepts, ask and answer questions, induce library research, or pose problems.

Bulletin boards may be either conceptual or manipulative. The conceptual board presents an idea, but does not provide the opportunity for student interaction. The manipulative board presents an idea and provides materials with which the students may interact. Both types of bulletin boards are excellent science communicative tools for teaching and learning science.


LET'S FIND OUT ABOUT
TREES
?
?
?
TRUNK
ROOTS
CROWN
Be a tree detective
Tree leaf exhibit
Where does the water vapour come from?
(Leaves)


HOW DO SEEDS TRAVEL?
by wind
by explosion
by animals
by water
by insects
by birds
To grow seeds need:
Get a good look at seeds
Grow some seeds
Seeds we eat:

APPENDIX B
The National Science Teachers Association (NSTA)
Position Statements

AN NSTA POSITION STATEMENT:

Code of Practice on Use of Animals in Schools

This code of practice is recommended by the National Science Teachers Association for use throughout the United States by elementary, middle/junior high, and high school teachers and students. It applies to educational projects conducted and lessons taught involving live organisms in schools or in school-related activities, such as science fairs, science clubs, and science competitions.

The purpose of these guidelines is to enrich education by encouraging students to observe living organisms and to learn proper respect for life. The study of living organisms is essential for an understanding of living processes. This study must be coupled with the observance of humane animal care and treatment.

I. Care and Responsibility for Animals in the Classroom

A. A teacher must have a clear understanding of and a strong commitment to the responsible care of living animals before making any decision to use live animals for educational study. Preparation for the use of live animals should include acquisition of knowledge on care appropriate to the species being used including housing, food, exercise, and the appropriate placement of the animals at the conclusion of the study.

B. Teachers should try to assure that living animals entering the classroom are healthy and free of transmissible disease or other problems that may endanger human health. Not all species are appropriate. Wild animals are not appropriate because they may carry parasites or serious diseases.

C. Maintaining good health and providing optimal care based on an understanding of the life habits of each species used are of primary importance. Animal quarters shall be spacious, shall avoid overcrowding, and shall be sanitary. Handling shall be gentle. Food shall be appropriate to the animal's normal diet and of sufficient quantity and balance to maintain a good standard of nutrition at all times. No animal shall be allowed less than the optimum maintenance level of nutrition. Clean drinking water shall always be available. Adequate provision for care shall be made at all times, including vacation times.

D. All aspects of animal care and treatment shall be supervised by a qualified ADULT WHO IS KNOWLEDGEABLE ABOUT RESEARCH METHODS, BIOLOGY, CARE, AND HUSBANDRY OF THE SPECIES BEING STUDIED.

E. Supervisors and students should be familiar with literature on care and handling of living organisms. Practical training in these techniques is encouraged.

AN NSTA POSITION STATEMENT: (Continued)

Code of Practice on Use of Animals in Schools (Continued)

F. Adequate plans should be made to control possible unwanted breedings of the species during the project period.

G. Appropriate plans should be made for future care of the animals at the conclusion of the study.

H. As a general rule, laboratory-bred animals should not be released into the wild as they may disturb the natural ecology of the environment.

I. On rare occasions, it may be necessary to sacrifice an animal for educational purposes. This shall be done only in a manner accepted and approved by the American Veterinary Association, by a person experienced in these techniques, and at the discretion of the teacher. It should not be done in the presence of immature or young students, who may be upset by witnessing such a procedure. Maximum efforts should be made to study as many biological principles as possible from a single animal.

J. The procurement, care, and use of animals must comply with existing local, state, and federal regulations.

II. **Experimental Studies of Animals in the Classroom**

A. When biological procedures involving living organisms are called for, every effort should be made to use plants or invertebrate animals when possible.

B. No experimental procedure that causes the animal unnecessary pain or discomfort shall be attempted on mammals, birds, reptiles, amphibians, or fish.

C. It it recommended that preserved vertebrate specimens be used for dissections.

D. Students shall not perform dissection surgery on vertebrate animals except under direct supervision of a qualified biomedical scientist or trained adult supervisor.

E. Experimental procedures including the use of pathogens, ionizing radiation, toxic chemicals, and chemicals producing birth defects must be under the supervision of a biomedical scientist or an adult trained in the specific techniques. Such procedures should be done in appropriate laboratory facilities that adhere to safety guidelines.

AN NSTA POSITION STATEMENT: (Continued)

Code of Practice on Use of Animals in Schools (Continued)

F. Behavior studies should use only reward (such as providing food) and not punishment in training programs. When food is used as a reward, it should not be withheld for more than 12 hours.

G. If embryos are subjected to invasive or potentially damaging experimental manipulation, the embryo must be destroyed prior to hatching. If normal embryos are hatched, provisions must be made for their care and maintenance.

III. Research Investigations Involving Vertebrate Animals

The National Science Teachers Association recognizes that an exceptionally talented student may wish to conduct research in the biological or medical sciences and endorses procedures for student research as follows:

A. Protocols of extracurricular projects involving animals should be reviewed in advance of the start of the work by a qualified adult supervisor.

B. Preferably, extracurricular projects should be carried out in an approved area of the school or research facility.

C. The project should be carried out with the utmost regard for the humane care and treatment of the animals involved in the project.

- Adopted by the NSTA Board of Directors in July, 1985

AN NSTA POSITION STATEMENT:

Liability of Teachers for Laboratory Safety and Field Trips

Laboratory investigations and field trips are essential to effective science instruction. Teachers should be encouraged to use these instructional techniques because physical on-site activity is important to the development of knowledge, concepts, processes, skills, and scientific attitudes. Inherent in such physical activities is the potential for injury with possible resulting litigation. All such liability must be shared by both school districts and teachers, utilizing clearly defined safety procedures and a prudent insurance plan. The National Science Teachers Association recommends that school districts and teachers adhere to the following guidelines:

I. School districts should develop and implement safety procedures for laboratory investigations and field trips.

II. School districts should be responsible for the actions of their teachers and be supportive of the use of laboratory activities and field trips as teaching techniques.

III. School districts should look to NSTA for help in informing teachers about safety procedures and encouraging them to act responsibly in matters of safety and related liability.

IV. School districts should provide liability and tort insurance for their teachers.

V. Teachers, acting as agents of the school districts, should utilize laboratory investigations and field trips as instructional techniques.

VI. Teachers should learn safe procedures for laboratory activities and field trips and should follow them as a matter of policy.

VII. Teachers should exercise reasonable judgment and supervision during laboratory activities and field trips.

VIII. Teachers should expect to be held liable if they fail to follow district policy and if litigation ensues.

IX. School districts and teachers should share the responsibilities of establishing safety standards and of seeing that they are adhered to.

-Adopted by the NSTA Board of Directors in July, 1985

AN NSTA POSITION STATEMENT:

Use of the Metric System

The efficiency and effectiveness of the metric system have long been evident to scientists, engineers, and educators. Because the metric system is used in all industrial nations except the United States, it is the position of the National Science Teachers Association that the International Systems of Units (SI) and its language be incorporated as an integral part of the education of children at all levels of their schooling. Therefore, we recommend that the following actions be taken:

I. We assume responsibility for leadership in teaching the metric system.

II. We urge that use of the metric system be integrated into all curriculum subjects and at every grade level.

III. We recognize that the use of the customary units will persist for some time, especially in the early grades, but will encourage the use of the metric system whenever possible.

IV. We urge the re-establishment of the U.S. Metric Board to support and encourage the use of the metric system nationwide.

-Adopted by the NSTA Board of Directors in July, 1985

AN NSTA POSITION STATEMENT:

Science for the Handicapped

An appropriate science education is extremely important for all people living in today's complex society; thus, to exclude any group of people, such as the handicapped, from pursuing either an education or a career in science not only hurts those people but also hurts our society, for this exclusion creates an unnecessary and undesirable waste of human potential.

NSTA therefore affirms its commitment for equal access to quality science education, including the use of new technologies, such as computers, for all youth and school personnel. And NSTA encourages and confirms the right of handicapped individuals to pursue careers in science and science teaching.

NSTA urges that all science conventions and meetings be fully accessible to the handicapped.

-Adopted by the NSTA Board of Directors in July, 1985

AN NSTA POSITION STATEMENT:

The Importance of Earth Science Education

K-12 earth science plays a unique and essential role in today's rapidly changing world. It is an integrated study of the earth's history, composition and structure, its atmosphere and oceans, and its environment in space. A knowledge of earth science is important, because most human activities are related to interaction with the planet Earth.

Basic knowledge about the earth, then, is the key to the development of an informed citizenry. The reasons for teaching earth science are numerous: it offers experience in a diverse range of interrelated scientific disciplines; it is closely related to the students' natural surroundings; and it offers students subject matter that has direct application to their lives and the world around them. They need only step outdoors to observe and find relevance in concepts learned in the earth science classroom. Because it offers many opportunities to collect data, hypothesize, experiment, and draw conclusions, both within school and outside environments, earth science is a laboratory- and activity-oriented course. Earth science integrates many principles of both physical and life sciences. It incorporates and presents concepts often not emphasized in other parts of the science curriculum, such as geologic time and the vastness of space.

The teaching of earth science allows all students to have a better science background with pertinent information about their surroundings. Daily, society is faced with environmental and economic concerns, such as acid rain, water supply, the greenhouse effect, and waste disposal. Civilization is absolutely dependent upon the utilization of earth's energy and mineral and human resources. Awareness of natural phenomena, such as floods, tornadoes, hurricanes, volcanoes, and earthquakes, also requires a knowledge of earth science.

Students who study earth science are better prepared to discuss issues and to make informed, responsible decisions. The interdisciplinary curriculum of earth science develops and builds on skills learned in earlier grades and closely relates to the students' everyday experiences. It develops attitudes and problem-solving skills that will be useful throughout life. If tomorrow's adults are to make wise decisions about earth and environmental issues, it is vital that today's students be given the opportunity to study earth science at all levels as an integral part of their education as well as an invaluable part of their high school experience.

-Adopted by the NSTA Board of Directors in July, 1987

APPENDIX C
Alabama Law Relative to Safety Goggles

Alabama Law Relative to Safety Goggles*

16-1-7. Eye protective devices for pupils and teachers participating in certain courses.

(a) Every pupil and every teacher in the public schools shall wear industrial quality eye protective devices while participating in the following courses:

(1) Vocational or industrial arts, shops or laboratories involving experiences with:

a. Hot molten metals;

b. Milling, sawing, turning, shaping, cutting or stamping of any solid materials;

c. Heat treatment, tempering or kiln firing any metal or other materials;

d. Gas or electric arc welding;

e. Repair or servicing of any vehicle;

f. Caustic or explosive materials.

(2) Chemical or combined chemical-physical laboratories involving caustic or explosive chemicals or hot liquids or solids.(b) The board of education or other governing authority of each school shall furnish the eye protective devices prescribed in this section free of charge to the pupils and teachers of the school participating in the courses described in in subsection (a) of this section. The county board of education or other governing authority shall furnish eye protective devices to all visitors to the courses heretofore named.

(b) The board of education or other governing authority of each school shall furnish the eye protective devices prescribed in this section free of charge to the pupils and teachers of the school participating in the courses described in subsection (a) of this section. The county board of education or other governing authority shall furnish eye protective devices to all visitors to the courses heretofore named.

(c) "Industrial quality eye protective devices" as used in this section shall mean devices meeting the current standards of the American standard safety code for head, eye and respiratory protection, promulgated by the American Standards Association, Incorporated. (Acts 1965, 1st Ex. Sess., No. 168, p. 219, appvd. April 5, 1965)

*From Laws of Alabama Relating to Education, Annotated, Revised 1983 Edition, Authorized by the (Alabama) State Board of Education, The Harrison Company, Norcross, Georgia, 1983.